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EFFECTS OF VARIOUS SIGHTING FACTORS ON ESTIMATES OF SIZES OF DOLPHIN SCHOOLS IN THE EASTERN TROPICAL PACIFIC OCEAN

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ABSTRACT

The U.S. purse-seine fishery for tropical tunas in the eastern Pacific Ocean uses schools of dolphins to locate schools of tuna with which they are associated. Under the Marine Mammal Protection Act, NMFS has the task to determine the abundance of these dolphins. Abundance estimation requires estimates of mean sizes of schools of dolphin using data gathered by scientific observers aboard tuna vessels, research vessels and survey aircraft. Various sighting factors are associated with estimates of school size. The effects of nine factors on school size were investigated. Significance of effects depended on the data set used. Effects of school type, year, distance and platform were significant using all data combined. School type, area, cue and set/no set were significant using tuna vessel data alone. School type and year were significant using research vessel data alone. In many cases, tests of significance were inconclusive -- factors were significant only in some levels of other factors.

INTRODUCTION

Schools of several species of dolphin in the eastern tropical Pacific Ocean (ETP), principally spotted dolphin (Stenella attenuata) and spinner dolphin (S. longerostris), travel in the company of yellowfin (Thunnus albacares), the dolphin swimming at the surface above the tuna in an association of unknown cause (Perrin 1969). The purse seine fishery for tropical tuna in the ETP uses these dolphin to locate schools of

associated tuna. In the process of fishing, nets are set around both the school of dolphin and the school of tuna. Fishermen then attempt to release the dolphin and keep the tuna using the technique of backdown (Coe et al. 1984). Occasionally, the process results in killing or injuring some of the captured dolphin.

Partly in response to this incidental killing of dolphin, the Marine Mammal Protection Act of 1972 established guidelines for regulating the take of dolphin incidental to purse-seine fishing for tuna by U.S. fishermen. The act, and a subsequent court ruling, assigns to the National Marine Fisheries Service (NMFS) the task to determine the abundance of dolphin associated with the fishery (Richey, 1976).[1]

The technique used by researchers in NMFS to estimate abundance is described by Holt and Powers (1982). The technique requires an estimate of the mean size of schools of dolphin. School size has been estimated by several investigators (Brazier 1978; Holt and Powers 1982). Brazier also investigated the effects of factors associated with sightings on estimates of mean school size using one-way analysis of variance (ANOVA). His analysis was partially extended by Holt and Powers (1982) who used multi-way ANOVA to test the effects of area and season on estimates.

The research I describe extended the earlier studies. In my analysis I used multi-way ANOVA rather than one-way ANOVA as used by Brazier. I included nine factors in my analysis, whereas Holt and Powers used two. Brazier used eight factors. He included the factor sun angle, a factor I

did not use. I included factors school type (i.e., species or group of species) and sea state, factors not used by Brazier or by Holt and Powers. I analyzed data collected during 1977-1982 while both Brazier and Holt and Powers used data for an earlier period, 1974-1977.

The purpose of my analysis was to show, using a general statistical tool, which of several factors associated with sighting schools of dolphin have significant effects on estimates of mean school size. I have not investigated details of processes that generated the data nor have I attempted to determine which stratification of levels of the factors, if any, yields school size estimates most nearly representative of the underlying population.

METHODS AND MATERIALS

Data

Data consisted of estimates of dolphin school size made by scientific observers during the period 1977 - 1983. Observers were trained by NMFS and the Inter-American Tropical Tuna Commission (IATTC) and were placed aboard research vessels, research aircraft, and tuna vessels to collect information on populations of dolphin.

The data set was a subset of a larger one collected during 1971 - 1983. The larger set was not used because certain information was not collected in earlier years (e.g., estimates of school size made by observers aboard tuna vessels were not recorded for years before 1977). Data by platform and year were as follows:

Tuna vessel sightings	1977 - 1982
Research vessel sightings	1979 (Jordan and Cromwell) 1980 (Jordan and Cromwell) 1982 (Jordan) 1983 (Jordan) 1977 - 1982 Sightings made aboard various research and chartered fishing vessels on research cruises but not specifically designed to survey dolphin (Table 1)
Aerial survey sightings	1977, 1979

Sighting records included one to several estimates of school size. I selected specific estimates as follows.

1. Sightings from tuna vessels. Each observer was instructed to record three estimates for a school, his best estimate, an estimate that he knew to be high,and an estimate that he knew to be low. When it was recorded, I selected the best estimate. When no best estimate was recorded,but both high and low estimates were listed I used the average of these. When only a high or low was listed, I used that estimate.

2. Sightings from research vessels or research aircraft. Up to six observers each made three estimates (best, high and low) of the size of each school. I used the average of estimates by individual observers where individual estimates were selected from best, high and low as described above.

I edited the data set to eliminate records where data for categorical information (factors) in which I was interested were missing, or records on which estimated school size was less than 15 individuals.

Factors

Information on a number of factors associated with sightings was collected by observers along with estimates of dolphin school size (Brazier,1978). Based on the advice of members of Panel C of the Southwest Fisheries Center's series of pre-SOPS (Status of Porpoise Stocks) review panels,I selected eight factors as those most likely to have effects on school size.

Dolphin school type (species or species group)
Area of sighting
Season of sighting
Year of sighting
Sighting cue
Sea state
Distance from the survey trackline to the sighted dolphin school
Platform (e.g., tuna vessel, research vessel or research aircraft)

I considered additional factors for sightings made from tuna vessels: Set -- whether or not the sighting resulted in a set -- and Capacity -- the fish-carrying capacity of the vessel.

I stratified the data according to species composition of the sighted dolphin school. I assigned sightings to seven levels of the school type by the following criteria.

School type	Composition
1	> 90% spotted dolphin
2	> 90% spinner dolphin
3	> 90% striped dolphin, Stenella coeruleoalba
4	> 90% common dolphin, Delphinus delphis
5	> 90% spotted and spinner dolphin (neither alone comprises 90%)

6 Not type 1-5 but contains some spotted, spinner, striped or common dolphin.

7 Not type 1-6 but contains identified individuals of other dolphin species or unidentified dolphin.

I stratified data to area according to the scheme of Holt and Powers (1982). The correspondence between areas of Holt and Powers and strata of this analysis is as follows (Figure 1).

Holt and Powers area	Stratum
Calibration area	1
Inshore area (not in Calibration area, north of equator)	2
Offshore area - north of equator	3
Offshore area - south of equator	4
Inshore area - south of equator	5

Results of preliminary analysis indicated that approximately 90% of all sightings occurred in areas north of the equator. To reduce the number of cells in the analysis, I analyzed data for areas 1, 2 and 3, the principal areas of interest, and eliminated data from south of the equator.

I stratified the data to season based on the advice of the pre-SOPS review panel which felt that seasonality in sightings was best reflected by two periods (October to March and April to September).

Observers recorded sighting cue -- the physical occurrence that attracted the observer's attention to a dolphin school -- as one of six types: Birds, splashes, the subject dolphins, a ship, a whale, and other or unknown. Results of a preliminary analysis indicated that approximately 99% of all sightings resulted from sighting one of the first three cues; thus, I combined sightings corresponding to the last three categories. Since the cue "splashes" refers to splashes made by the subject dolphins, I also combined cues splashes and dolphins. Combining resulted in three levels of the factor: birds, splashes/dolphins and other.

I questioned experienced observers on the effect of sea state on observing conditions. They noted that conditions are excellent to good at Beaufort sea states 0, 1 and 2. Conditions begin to deteriorate with the appearance of whitecaps, which can be confused with splashes by dolphins, at Beaufort 3 and are poor for sea states greater than Beaufort 4. Therefore, I stratified the data to three levels of sea state Beaufort 0-2, Beaufort 3 and Beaufort 4+.

Assuming an average observing height of 30 feet above the water, the horizon is approximately 6.7 NM distant. Results of preliminary analysis indicated that approximately 44% of sightings are of cues located within a perpendicular distance of one NM from the vessel's trackline and approximately 73% are within 2 NM. Therefore I used three levels of sighting distance, 0-0.5 NM, 0.5-2 NM and greater than 2 NM.

Analysis

I used multi-way ANOVA to determine the effects of the factors on estimates of mean sizes of schools of dolphins. I assumed a fixed-effect model and a factorial design. I performed three series of analyses to enable testing the effects of factors unique to particular platforms from which data on school size were collected (all platforms, tuna vessels alone, research vessels alone). Numbers of observer estimates for the levels of the factors for various subsets of the data are listed in Table 2.

I used the SPSS program MANOVA (Hull and Nie, 1981). Difficulties with the number of treatment cells in the design -- the maximum size incorporates 20,412 cells -- combined with limitations of the available computer system dictated that the number of cells be reduced by performing separate analyses for different levels of those factors reasonably expected to have significant effects on estimates of school size. Results of preliminary analyses indicated that performing separate analyses for individual school types sufficiently reduced the number of cells. Since the effect of this factor was not tested, its effect on estimates of school size was assumed, a priori, to be significant.

Standard ANOVA results are listed for each analysis. To indicate the significance of effects of factors considering all school types together, I calculated combined significance levels. To create this combined statistic, I used the fact that the statistic minus two times the sum of the natural logarithms of the individual significance levels is distributed according to the chi-square distribution with degrees of freedom equal to twice the number of individual analyses (Snedecor 1967).

Observer estimates of dolphin school size were highly skewed to lower values; hence deviations from mean observed school sizes were not distributed normally - a violation of the normality assumption of ANOVA. To more nearly satisfy this assumption,I transformed the data to their natural-logarithms. In all cases the distribution of transformed school sizes was considerably nearer normal than the distribution of non-transformed school size (examples, Figure 2). Because of difficulties in

interpreting the results of tests of significance of higher-order interactions, tests were limited to main effects and first-order interactions.

Preliminary test: helicopter sightings

Some tuna vessels use helicopters to search for schools of dolphin, greatly increasing the area they can cover. Six percent of the estimates of school size in the data were of sightings initially made from helicopters, not a sufficient number to warrant making a new stratum. These estimates may not be homogeneous with the larger set of estimates made from tuna vessels not using aircraft and if not, should be omitted from the analysis.

The effect of helicopter sightings was studied by testing the effect of vessel capacity in 1977, before helicopters were carried on US vessels (C. Orange, Inter-American Tropical Tuna Commission, personal communication). I stratified these data to two categories of capacity at 1,000 ST (U.S. vessels under 1000 ST do not carry helicopters, C. Orange) Results of tests for the main effect capacity indicated that this factor did not have a significant effect on estimates of mean school size for those data (Table 3). Of the six first order interactions involving capacity, only three had a significant effect on estimates of school size. The significant intersections imply that the significance of capacity is uncertain -- its effect is different for different levels of factors with which it has a significant interaction. The results do suggest,however, that eliminating helicopter sightings would not cause a bias toward smaller vessels and I eliminated these sightings.

Preliminary test: sea state

Data on sea state associated with estimates of school size were collected beginning in 1979. To use the largest possible data set in the analysis I performed preliminary analyses for each series to determine if the factor sea state could be eliminated from the analysis. If sea state could be eliminated, then data collected in earlier years could be included. Tests were performed on a subset of the basic data set -- data collected between 1979 and 1983.

For data collected aboard all platforms combined, results indicated that, except for the interaction sea state x season, neither the main effect sea state nor any of the first order interactions involving sea state had a significant effect on estimates of school size (Table 4).

Results were the same for data collected aboard tuna vessels alone and for data collected aboard research vessels alone (Tables 5, 6).

These results suggested that for the data set analyzed, differences in estimates of school size were not related to sea state. Accordingly, the factor was omitted from the analysis and data from 1977 and 1978 were included in the data set.

RESULTS

Tests of effects of factors: all platforms combined

Results of tests, considering data collected from all platforms together, indicated that, of the six factors tested, the effects on estimates of mean school size of three -- year, platform and sighting distance -- were significant (Table 7). By assumption, the effects of school type were also significant. The effects of factors area, season and sighting cue were not significant. The effect of sea state was shown not significant in preliminary tests of the 15 first-order interactions; the effects of 10 were significant.

Tests of effects of factors: tuna vessels alone

Results of tests of data collected from tuna vessels alone indicated that of the seven factors tested, the effects on school size of three -- set, area and cue -- were significant (Table 8). By assumption, effects of school type were also significant. By preliminary test sea state was not significant. Effects of season, year, sighting distance and capacity were not significant. Of the 21 first-order interactions tested, the effects of 10 were significant.

Tests of effects of factors: research vessels alone

Considering data collected from research vessels alone, of the six factors tested the effects on mean school size of two factors -- school type and year -- were significant (Table 9). The effects of area, season,

sighting by assumption school type were not significant. By preliminary test, sea state was not significant, cue and sighting distance were not significant. Of the 15 first-order interactions tested, the effects of three were significant.

DISCUSSION

Results of tests of significance using the entire data set suggest that the factors school type, year, collecting platform and distance from the searching trackline all have significant effects on estimates of mean sizes of schools of dolphin. Sea state was not significant. These results are consistent with those of Brazier (1978) who also found the effect of platform (Brazier's "method") significant (Table 10). He found results to be inconclusive for year and distance -- the effects of these factors were different for different levels of platform. Since inconclusive allows at least partial significance, these results are not inconsistent with mine.

Tests of the significance of area, season and sighting cue were inconclusive since each was involved in at least one significant first-order interaction. Brazier also found tests of season inconclusive (Table 10). He found the cue significant. This difference is not inconsistent for reasons listed above.

Results of tests using tuna vessel data alone suggest that effects of factors school type, area, sighting cue and set are significant. Sea state was not significant. Brazier also found cue and set significant (Table 10). He found area not significant, opposite to my finding. This

difference is not surprising since the two analyses used data from completely different time periods and for different stratifications of area. Holt and Powers found tests of significance of area and season inconclusive which is consistent with my results. Significances of season, year and sighting distance were found inconclusive, consistent with results of Brazier and Holt and Powers.

Results of tests using research vessel data only suggest that effects of school type and year were significant while area, cue and sea state were not significant. Tests of season and distance were inconclusive. Brazier's results on the significance of year, cue and distance were opposite to mine (Table 10). The difference for year is not surprising since the analyses used data from different time periods. The other differences may stem in part from the same cause. The two analyses used different stratifications for season and sighting distance and differences in results are not unexpected.

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FOOTNOTES

[1] Richey, C. R. 1976. Memorandum of opinion. Case nos. 74-1465 and 75-0227. U.S. District Court, District of Columbia. May 11, 1976.

Table 1. Details of NOAA research cruises not designed to survey dolphin but on which sightings data were collected.

Cruise Number	Date	Vessel
232	March 24 - April 15, 1977	NOAA Oceanographer
234	April 5 - May 2, 1977	Zharbry
310	June 27 - July 29, 1977	NOAA Oceanographer
319	October 3 - November 21, 1977	NOAA Jordan
412	January 22 - May 3, 1978	Mary K.
428	August 2 - September 29, 1978	Regina Moris
564	September 27 - October 24, 1979	NOAA Jordan
642	March 21 - April 20, 1980	NOAA Oceanographer
646	June 17 - July 11, 1980	NOAA Jordan
648	July 21 - September 25, 1980	NOAA Researcher
687	January 20 - April 1, 1981	NOAA Oceanograher
716	May 25 - July 28, 1981	NOAA Oceanographer
798	April 5 - April 25, 1982	NOAA Jordan
801	May 13 - August 3, 1982	NOAA Jordan

Table 2. Distributions of observations of size of schools of dolphins over levels of factors associated with sightings. Distributions are in percent and are for different data sets. Sightings were made in the ETP.

Factor	Level	Data Set: TV[1] 77	All 79+	All 77+	TV 79+	TV 77+	RV 79+	RV 77+
School type	Spotted	41%	37%	37%	38%	38%	22%	22%
	Spinner	06	05	05	05	05	04	04
	Striped	02	04	03	03	03	12	12
	Common	15	13	14	13	14	16	16
	Spotted and Spinner	13	11	12	12	12	11	11
	Other key species	02	04	03	03	03	07	07
	Other dolphin	21	27	27	26	26	29	29
Area	Calibration	39%	38%	38%	39%	38%	31%	31%
	Inshore North	15	17	17	17	17	11	11
	Offshore North	46	45	45	44	44	58	58
Season	October - March	02%	48%	44%	47%	43%	52%	52%
	April - September	98	52	56	53	57	48	48
Year	1977	*[2]	-	10%	-	10%	-	01%
	1978	*	-	12	-	13	-	05
	1979	*	30%	24	30%	24	24%	22
	1980	*	24	18	24	18	28	26
	1981	*	19	14	20	15	10	09
	1982	*	16	12	16	12	15	14
	1983	*	12	09	11	08	24	22
Sighting cue	Birds	71%	58%	59%	60%	61%	30%	30%
	Splashes/dolphin	26	41	40	39	38	68	68
	Other	03	01	01	01	01	02	02
Sea state	Beaufort 0-2	*	53%	*	55%	*	43%	43%
	Beaufort 3	*	30	*	30	*	30	31
	Beaufort 4+	*	16	*	15	*	27	27
Sighting Distance	< 0.5 N. Miles	28%	29%	30%	29%	29%	22%	22%
	0.5-2 N. Miles	27	35	34	34	33	44	44
	> 2.0 N. Miles	45	36	36	37	38	24	24
Platform	Tuna Vessel	*	93%	94%	*	*	*	*
	Research Vessel	*	07	05	*	*	*	*
	Aircraft	*	trace	01	*	*	*	*
Set	No Set	58%	*	*	66%	66%	*	*
	Set	42	*	*	34	34	*	*
Capacity	< 1000 Short Tons	28%	*	*	30%	30%	*	*
	≥ 1000 Short Tons	72	*	*	70	70	*	*
Initial Sighting Location	Helicopter	02%	*	*	*	*	*	*
	Other	98	*	*	*	*	*	*
Number of Observations		2,327	17,626	23,367	16,345	21,890	1,185	1,266

[1] TV = Tuna Vessel, RV = Research Vessel
[2] * = Factor not used

Table 3. Results of analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphin sighted from tuna vessels in the ETP in 1977. An asterisk indicates significance at at least the 5% level.

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	2825.41773	2031	1.39115		
Constant	99.70294	1	99.70294	71.66964	0.000
Set	2.95096	1	2.95096	2.12124	0.145
ST*	32.18167	6	5.36361	3.85553	0.001*
AR	6.15575	2	3.07788	2.21248	0.110
SN	0.62713	1	0.62713	0.45030	0.502
CU	4.18648	2	2.09324	1.50469	0.222
PD	1.18093	2	0.59046	0.42444	0.654
CAP	1.42550	1	1.42550	1.02469	0.312
SET BY ST*	28.76836	6	4.79473	3.44660	0.002*
SET BY AR*	11.24388	2	5.62194	4.04123	0.018*
SET BY SN	0.22069	1	0.22069	0.15864	0.690
SET BY CU	5.56488	2	2.78244	2.00011	0.136
SET BY PD	0.01076	2	0.00538	0.00387	0.996
SET BY CAP	0.02573	1	0.02573	0.01849	0.892
ST BY AR*	36.63094	12	3.05258	2.19429	0.010*
ST BY SN*	21.21358	5	4.24272	3.04980	0.010*
ST BY CU	10.71095	11	0.97372	0.69994	0.740
ST BY PD	17.50998	12	1.45916	1.04889	0.400
ST BY CAP*	44.99030	6	7.49838	5.39008	0.000*
AR BY SN	4.91815	2	2.45908	1.76766	0.171
AR BY CU*	17.04059	4	4.26015	3.06233	0.016*
AR BY PD	3.75554	4	0.93888	0.67490	0.609
AR BY CAP*	31.49187	2	15.74594	11.31868	0.000*
SN BY CU	3.76045	2	1.88022	1.35156	0.259
SN BY PD	4.57016	2	2.28508	1.64259	0.194
SN BY CAP	0.06105	1	0.06105	0.04388	0.834
CU BY PD*	31.03121	4	7.75780	5.57655	0.000*
CU BY CAP*	14.30737	2	7.15368	5.14229	0.006*
PD BY CAP	2.69914	2	1.34957	0.97011	0.379

[1]Abbreviations: ST = schooltype; AR = area; SN = season; CV = sighting cue; PD = perpendicular sighting distance; CAP = fish-carrying capacity of tuna vessels.

Table 4. Significance levels of F combined over levels of the factor school type (see text) for the factor sea state and first-order interactions involving sea state. Significance levels from analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphins sighted from tuna vessels, research vessels and aircraft in the ETP between 1979 and 1983 (Appendix Table 1). An asterisk indicates significance at at least the 5% level.

Factor of Interaction	Combined Significance
Sea State	11.21
Sea State X Area	7.52
Sea State X Season*	29.10*
Sea State X Year	19.23
Sea State X Cue	14.04
Sea State X Platform	13.15
Sea State X Distance	23.15

Table 5. Significance levels of F combined over levels of the factor school type (see text) for the factor sea state and first order interactions involving sea state. Significance levels from analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphin sighted from tuna vessels in the ETP between 1979 and 1983 (Appendix Table 2). An asterisk indicates significance at at least the 5% level.

Factor or Interaction	Combined Significance
Sea State	8.70
Sea State X Set	13.69
Sea State X Area	9.88
Sea State X Season	21.01
Sea State X Year	16.49
Sea State X Cue	7.84
Sea State X Distance	25.25
Sea State X Capacity	13.15

Table 6. Significance levels of F combined over levels of the factor school type (see text) for the factor sea state. Significance levels from analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphin sighted from research vessels in the ETP between 1979 and 1983 (Appendix Table 3). An asterisk indicates significance at at least the 5% level.

Factor or Interaction	Combined Significance
Sea State	10.28
Sea State X Area	22.81
Sea State X Season	14.49
Sea State X Year	18.01
Sea State X Cue	5.22
Sea State X Distance	10.66

Table 7. Combined significance levels of F from analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphins. Significance levels combined over levels of the factor school type (see text). Schools sighted from tuna vessels, research vessels and aircraft in the ETP between 1977 and 1983 (Appendix Table 4). An asterisk indicates significance at at least the 5% level.

Factor or Interaction	Combined Significance
Area	23.12
Season	19.62
Year*	30.98*
Cue	17.45
Platform*	>CV*[1]
Distance*	34.03*
Area X Season*	38.79*
Area X Year*	52.01*
Area X Cue*	>CV*
Area X Platform	14.39
Area X Distance*	29.20*
Season X Year*	>CV*
Season X Cue	21.42
Season X Platform*	26.93*
Season X Distance	18.01
Year X Cue*	30.08*
Year X Platform*	>CV*
Year X Distance	19.66
Cue X Platform	13.10
Cue X Distance*	>CV*
Platform X Distance*	35.67*

[1]>CV = Significance level format least one level of school type is 0, Hence combined levels are greater than the critical value.

Table 8. Combined significance levels of F from analysis of variance of effects of sighting factors on estimates of mean size of schools of dolphins. Significance levels combined over levels of the factor school type (see text). Schools sighted from tuna vessels in the ETP between 1977 and 1983 (Appendix Table 5). An asterisk indicates significance at at least the 5% level.

Factor of Interaction	Combined Significance
Set*	>CV*[1]
Area*	38.99*
Season	12.66
Year	24.19
Cue*	>CV*
Distance	24.46
Capacity	16.77
Set X Area*	>CV*
Set X Season	12.96
Set X Year*	>CV*
Set X Cue*	>CV*
Set X Distance	18.85
Set X Capacity	14.11
Area X Season*	33.15*
Area X Year*	56.15*
Area X Cue*	>CV*
Area X Distance*	28.01*
Area X Capacity*	30.20*
Season X Year*	>CV*
Season X Cue	21.42
Season X Distance	11.84
Season X Capacity	12.74
Year X Cue	17.54
Year X Distance	19.64
Year X Capacity*	>CV*
Cue X Distance*	>CV*
Cue X Capacity	6.54
Distance X Capacity	13.02

[1]>CV = Significance level for at least one level of school type is 0. Hence combined levels are greater than the critical value.

Table 9. Results of analysis of variance of sighting factors on estimates of mean size of schools of dolphins sighted from research vessels in the ETP between 1977 and 1983. An asterisk indicates significance at at least the 5% level.

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	722.97225	883	0.81877		
Constant	38.71404	1	38.91404	47.52755	0.000
ST*	13.90914	6	2.31819	2.83131	0.010*
AR	2.44818	2	1.22409	1.49504	0.225
SN	1.76254	1	1.76254	2.15267	0.143
YR*	10.67873	6	1.77979	2.17374	0.043*
CU	0.49461	2	0.24731	0.30205	0.739
PD	3.69034	2	1.81517	2.25359	0.106
ST BY AR	11.17076	12	0.93090	1.13695	0.226
ST BY SN	7.93456	6	1.32243	1.61514	0.140
ST BY YR*	57.50385	32	1.79700	2.19476	0.000*
ST BY CU	5.56241	9	0.61805	0.75485	0.659
ST BY PD*	20.07991	12	1.67333	2.04371	0.018*
AR BY SN	2.90381	2	1.45191	1.77328	0.170
AR BY YR	12.46759	10	1.24676	1.52272	0.126
AR BY CU	4.18254	4	1.01563	1.27708	0.277
AR BY PD	2.09396	4	0.52349	0.63936	0.635
SN BY YR*	11.11223	4	2.77806	3.39297	0.009*
SN BY CU	3.88350	2	1.94175	2.37155	0.094
SN BY PD	4.19013	2	2.09507	2.55880	0.078
YR BY CU	12.66715	9	1.40746	1.71900	0.081
YR BY PD	11.27571	12	0.93964	1.14763	0.317
YR BY PD	1.93832	4	0.48458	0.59184	0.669

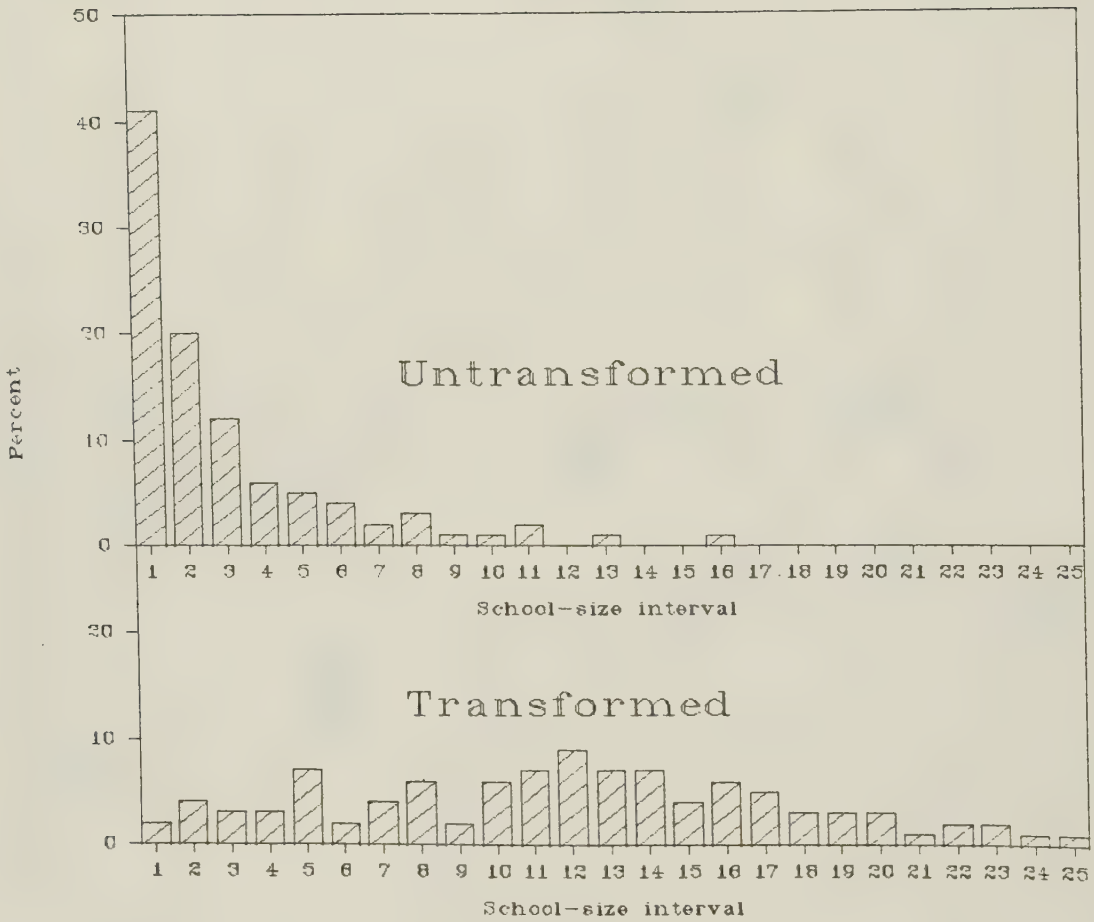
[1]Abbreviations defined in Table 3 and Appendix Table 1.

Table 10. Results of tests of significance of factors associated with sighting dolphin schools on estimates of mean school size. Results are from three analyses.[1]

Factor	Platform						
	All		Tuna Vessel		Holt & Powers	Research Vessel	
	Present	Brazier	Present	Brazier		Present	Brazier
School Type	S[2]	-	S	-	-	S	-
Area	INC	-	S	NS	INC	NS	-
Season	INC	INC	INC	INC	INC	INC	NS
Year	S	INC	INC	S	-	S	NS
Cue	INC	S	S	S	-	NS	S
Platform	S	S	-	-	-	-	-
Distance	S	INC	INC	INC	-	INC	NS
Set	-	-	S	S	-	-	-
Sea State	NS	-	NS	-	-	NS	-

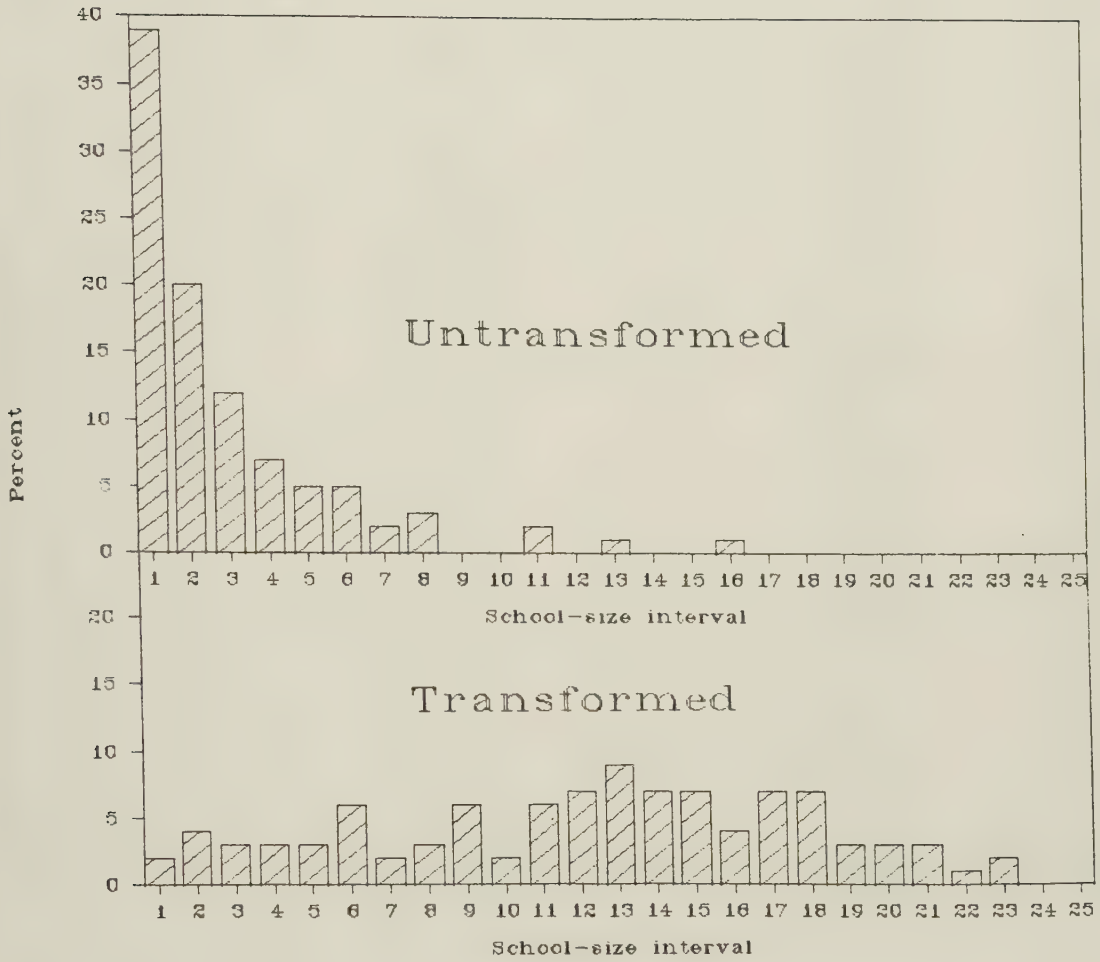
[1]Analyses: Present study, Brazier (1978), Holt and Powers (1982).
[2]Symbols: S = Effect is Significant, NS = Not Significant, INC = Result is Inconclusive, - = Effect of Factor Not Tested.

Figure 1. Areas in which estimates of sizes of sighted schools of dolphins were made by observers.



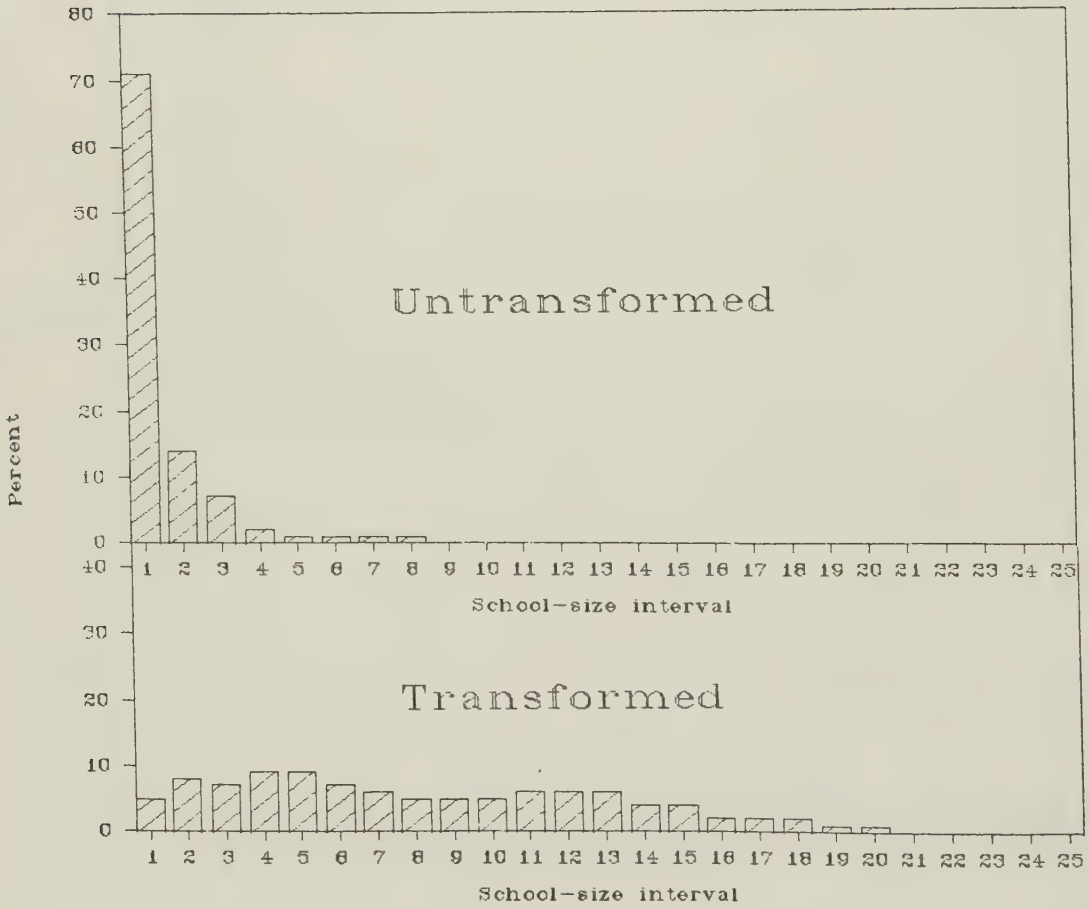
A. Tuna vessels, research vessels, aircraft, 1977-1983.

Figure 2. Distributions of estimates of sizes of sighted schools and of natural logarithms of estimates over size intervals for various combinations of platform from which sightings were made and years. For untransformed data interval 1 is 15-200 individuals; interval 2 is 201-400; succeeding intervals are 200 individuals; interval 25 is 4801 or more individuals. For transformed data interval 1 is log 15 - log 200, etc.



B. Tuna vessels, 1977-1983.

Figure 2. Continued



C. Research vessels, 1977-1983.

Figure 2. Continued

Appendix Table 1. Detailed results of analysis of variance, tuna vessels, research vessels and aircraft, 1979-1983. Individual tables list results by schooltype (see text). Results are summarized in Table 4.

A. School Type 1

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	7597.91065	5885	1.29106		
Constant	242.43701	1	242.43701	187.78081	0.000
AR	1.68742	2	0.84371	0.65350	0.520
SN	3.30576	1	3.30576	2.56049	0.110
YR*	14.71984	4	3.67996	2.85033	0.023*
CU	0.64227	2	0.32113	0.24874	0.780
BF	4.80255	2	2.40127	1.85992	0.156
OBT*	20.01355	2	10.00677	7.75080	0.000*
PD	1.54734	2	0.77367	0.59925	0.549
AR BY SN*	13.81198	2	6.90599	5.34907	0.005*
AR BY YR*	30.58847	8	3.82356	2.96156	0.003*
AR BY CU	4.52817	4	1.13204	0.87683	0.477
AR BY BF	5.95467	4	1.48867	1.15305	0.330
AR BY OBT	1.29969	4	0.32492	0.25167	0.909
AR BY PD	4.79642	4	1.19910	0.92877	0.446
SN BY YR*	55.25656	4	13.81414	10.69981	0.000*
SN BY CU	0.02927	2	0.01454	0.01126	0.989
SN BY BF	7.48527	2	3.74263	2.89888	0.055
SN BY OBT	4.52806	1	4.52806	3.50723	0.061
SN BY PD	1.30962	2	0.65481	0.50719	0.602
YR BY CU	19.21156	8	2.40145	1.86005	0.062
YR BY BF	12.88556	8	1.61069	1.24757	0.267
YR BY OBT*	36.72034	4	9.1809	7.11048	0.000*
YR BY PD	18.83635	8	2.35454	1.82372	0.068
CU BY BF	3.65595	4	0.9199	0.70793	0.586
CU BY OBT	1.73590	1	1.73590	1.34455	0.246
CU BY PD*	52.66493	4	13.16623	10.19797	0.000*
BF BY OBT	3.71036	3	1.2379	0.95796	0.412
BF BY PD*	14.01472	4	3.50368	2.71379	0.029*
OBT BY PD	1.56865	3	0.52288	0.40500	0.749

[1]BF = Sea State
OBT = Platform
Other abbreviations defined in Table 3

Appendix Table 1. Continued

B. School Type 2

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	632.36234	497	1.27236		
Constant	69.51474	1	69.51474	54.63454	0.000
AR	0.45763	2	0.22882	0.17984	0.835
SN	2.37705	1	2.37705	1.86822	0.172
YR*	13.40277	4	3.35069	2.63345	0.034*
CU	6.66904	2	3.33452	2.62074	0.074
BF	1.06982	2	0.53491	0.42041	0.657
OBT	4.46967	2	2.23484	1.75645	0.174
PD*	10.05389	2	5.02695	3.95089	0.020*
AR BY SN	1.53973	2	0.76987	0.60507	0.546
AR BY YR*	21.36681	8	2.67085	2.09913	0.034*
AR BY CU	1.79364	3	0.59788	0.46990	0.703
AR BY BF	1.53734	4	0.38433	0.30206	0.877
AR BY OBT	0.81352	3	0.27117	0.21313	0.887
AR BY PD	2.80389	4	0.70097	0.55092	0.698
SN BY YR*	25.52713	4	6.38178	5.01571	0.001*
SN BY CU	1.07549	2	0.53775	0.42264	0.656
SN BY BF	2.28482	2	1.14241	0.89787	0.408
SN BY OBT	2.51549	1	2.51549	1.97703	0.160
SN BY PD	1.44290	2	0.72145	0.56702	0.568
YR BY CU	4.54515	5	0.90903	0.71444	0.613
YR BY BF	9.63288	8	1.20411	0.94636	0.478
YR BY OBT*	13.51008	4	3.37752	2.65453	0.032*
YR BY PD	8.12974	8	1.01622	0.79869	0.604
CU BY BF	2.57041	3	0.85680	0.67340	0.569
CU BY OBT	0.49658	1	0.49658	0.39028	0.532
CU BY PD*	29.35371	2	14.67686	11.53516	0.000*
BF BY OBT	11.97462	4	2.99365	2.35284	0.053
BF BY PD	8.09106	4	2.02277	1.58978	0.176
OBT BY PD	1.52201	4	0.38050	0.29905	0.879

Appendix Table 1. Continued

C. School Type 3

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	302.89082	359	0.84371		
Constant	10.45269	1	10.45269	12.38901	0.000
AR	1.34668	2	0.67334	0.79807	0.451
SN	0.03511	1	0.03511	0.04161	0.838
YR	3.21100	4	0.80275	0.95146	0.434
CU	0.39334	2	0.19667	0.23310	0.792
BF	0.94644	2	0.47322	0.56088	0.571
OBT	1.10937	2	0.55469	0.65744	0.519
PD	2.84233	2	1.42116	1.68443	0.187
AR BY SN	1.26965	2	0.63483	0.75242	0.472
AR BY YR	7.27215	8	0.90902	1.07741	0.378
AR BY CU	4.52546	4	1.13136	1.34094	0.254
AR BY BF	1.78769	4	0.44692	0.52971	0.714
AR BY OBT*	7.67790	3	2.55930	3.03340	0.029*
AR BY PD	5.50645	4	1.37661	1.63162	0.166
SN BY YR	4.62105	4	1.15526	1.36927	0.244
SN BY CU	1.49812	2	0.74906	0.88782	0.412
SN BY BF*	10.98209	2	5.44604	6.45490	0.002*
SN BY OBT	0.03954	1	0.03954	0.04686	0.829
SN BY PD*	7.96544	2	3.98272	4.72050	0.009*
YR BY CU	3.66419	6	0.61070	0.72383	0.631
YR BY BF	8.59174	8	1.07397	1.27291	0.256
YR BY OBT	5.80170	4	1.45043	1.71911	0.145
YR BY PD	5.90515	8	0.73814	0.87488	0.538
CU BY BF	1.99965	3	0.66655	0.79002	0.500
CU BY OBT	1.69811	2	0.84905	1.00634	0.367
CU BY PD	2.94360	2	1.47180	1.74444	0.176
BF BY OBT	0.26054	3	0.08685	0.10294	0.958
BF BY PD	2.31084	4	0.57771	0.68473	0.603
OBT BY PD*	14.02444	2	7.01222	8.31120	0.000*

Appendix Table 1. Continued

D. School Type 4

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	3664.57280	1914	1.91461		
Constant	183.33278	1	183.33278	95.75439	0.000
AR	9.24215	2	4.62108	2.41358	0.090
SN	0.39217	1	0.39217	0.20483	0.651
YR	6.47411	4	1.61853	0.84535	0.496
CU	1.12449	2	0.56225	0.29366	0.746
BF	3.79735	2	1.89867	0.99167	0.371
OBT	4.44208	2	2.22104	1.16005	0.314
PD	1.35710	2	0.67855	0.35441	0.702
AR BY SN	10.97603	2	5.48802	2.86638	0.057
AR BY YR	22.83968	8	2.85496	1.49114	0.155
AR BY CU*	19.36915	4	4.84229	2.52912	0.039*
AR BY BF	2.99939	4	0.74985	0.39164	0.815
AR BY OBT	4.60161	4	1.15040	0.60085	0.662
AR BY PD	7.28655	4	1.82164	0.95144	0.433
SN BY YR*	33.75798	4	8.43950	4.40793	0.002*
SN BY CU*	18.16042	2	9.08021	4.74258	0.009*
SN BY BF	4.58385	2	2.29193	1.19707	0.302
SN BY OBT	0.86766	2	0.43383	0.22659	0.797
SN BY PD	0.31138	2	0.15569	0.08132	0.922
YR BY CU	16.14230	8	2.01779	1.05389	0.393
YR BY BF	11.39139	8	1.42392	0.74371	0.653
YR BY OBT*	32.46881	4	8.11720	4.23960	0.002*
YR BY PD	20.37069	8	2.54634	1.32995	0.224
CU BY BF	5.74208	4	1.43552	0.74977	0.558
CU BY OBT	2.98919	2	1.49460	0.78062	0.458
CU BY PD*	20.91856	4	5.22964	2.73143	0.028*
BF BY OBT	3.57790	4	0.89447	0.46718	0.760
BF BY PD	13.53344	4	3.38336	1.76712	0.133
OBT BY PD	6.00862	4	1.50215	0.78457	0.535

Appendix Table 1. Continued

E. School Type 5

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	1416.18165	1616	0.87635		
Constant	135.62039	1	135.62039	154.75596	0.000
AR	0.43893	2	0.21946	0.25043	0.778
SN	2.35326	1	2.35326	2.68530	0.101
YR*	14.36536	4	3.59134	4.09807	0.003*
CU	2.47774	2	1.23887	1.41367	0.244
BF	0.99646	2	0.49823	0.56853	0.566
OBT*	6.35143	1	6.35143	7.24759	0.007*
PD*	9.41247	2	4.70623	5.37027	0.005*
AR BY SN*	7.45600	2	3.72800	4.25401	0.014*
AR BY YR*	18.47296	8	2.30912	2.63493	0.007*
AR BY CU	2.67935	3	0.89312	1.01913	0.383
AR BY BF	1.47764	4	0.36941	0.42153	0.793
AR BY OBT	0.04530	2	0.02265	0.02584	0.974
AR BY PD	8.04355	4	2.01089	2.29462	0.057
SN BY YR*	11.57613	4	2.89403	3.30237	0.011*
SN BY CU*	4.12839	1	4.12839	4.71089	0.030*
SN BY BF	2.43918	2	1.21959	1.39167	0.249
SN BY OBT*	6.00808	1	6.00808	6.85580	0.009*
SN BY PD	2.33991	2	1.16996	1.33503	0.263
YR BY CU*	9.78225	4	2.44556	2.79062	0.025*
YR BY BF*	14.96509	8	1.87064	2.13458	0.030*
YR BY OBT*	25.28966	4	6.32241	7.21449	0.000*
YR BY PD	8.88374	8	1.11047	1.26715	0.256
CU BY BF	0.58189	2	0.29095	0.33200	0.718
CU BY OBT	0.45364	1	0.45364	0.51765	0.472
CU BY PD*	10.17530	2	5.08765	5.80550	0.003*
BF BY OBT	0.34149	2	0.17074	0.19483	0.823
BF BY PD	4.40867	4	1.10217	1.25768	0.285
OBT BY PD*	6.07597	2	3.03798	3.46663	0.031*

Appendix Table 1. Continued

F. School Type 6

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	403.84491	331	1.22008		
Constant	87.94260	1	87.94260	72.07963	0.000
AR	2.41709	2	1.20854	0.99055	0.372
SN	3.60970	1	3.60970	2.95859	0.086
YR*	19.12369	4	4.78092	3.91855	0.004*
CU	2.02365	2	1.01182	0.82931	0.437
BF	2.13114	2	1.06557	0.87337	0.419
OBT*	24.38276	1	24.38276	19.98464	0.000*
PD*	9.33558	2	4.66779	3.82582	0.023*
AR BY SN	1.25650	2	0.62825	0.51493	0.598
AR BY YR	18.49709	8	2.31214	1.89508	0.060
AR BY CU	1.61430	3	0.53810	0.44104	0.724
AR BY BF	1.82302	4	0.45576	0.37355	0.827
AR BY OBT	1.47112	2	0.73556	0.60288	0.548
AR BY PD	6.47678	4	1.61920	1.32713	0.260
SN BY YR	5.13347	4	1.28337	1.05188	0.380
SN BY CU	0.42416	2	0.21208	0.17383	0.841
SN BY BF	3.63262	2	1.81631	1.48869	0.227
SN BY OBT*	7.60125	1	7.60125	6.23015	0.013*
SN BY PD	2.09455	2	1.04727	0.85837	0.425
YR BY CU	1.44511	4	0.36128	0.29611	0.880
YR BY BF	9.37600	8	1.17200	0.96060	0.467
YR BY OBT*	16.44536	4	4.11134	3.36974	0.010*
YR BY PD	10.66324	8	1.33291	1.09248	0.368
CU BY BF	4.99053	2	2.49526	2.04517	0.131
CU BY OBT	0.01348	1	0.01348	0.01104	0.916
CU BY PD	0.82337	2	0.41169	0.33743	0.714
BF BY OBT	3.17127	2	1.58564	1.29962	0.274
BF BY PD	3.18831	4	0.79708	0.65330	0.625
OBT BY PD	2.29323	2	1.14661	0.93979	0.392

Appendix Table 1. Continued

G. School Type 7

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	5856.13637	4069	1.43921		
Constant	239.84336	1	239.84336	166.64957	0.000
AR	4.97586	2	2.48793	1.72868	0.178
SN	0.14333	1	0.14333	0.09959	0.752
YR*	14.14573	4	3.53643	2.45721	0.044*
CU	4.11163	2	2.05581	1.42843	0.240
BF	0.96771	2	0.48386	0.33620	0.715
OBT*	50.54268	2	25.27134	17.55920	0.000*
PD	2.92589	2	1.46294	1.01649	0.362
AR BY SN	7.36802	2	3.68401	2.55975	0.078
AR BY YR	22.19458	8	2.77432	1.92767	0.052
AR BY CU*	38.25780	4	9.56445	6.64564	0.000*
AR BY BF	8.41435	4	2.10359	1.46163	0.211
AR BY OBT	1.81794	4	0.45449	0.31579	0.868
AR BY PD*	18.05708	4	4.51427	3.13664	0.014*
SN BY YR	6.81369	4	1.70342	1.18358	0.316
SN BY CU	0.68911	2	0.34455	0.23940	0.787
SN BY BF	1.34815	2	0.67408	0.46837	0.626
SN BY OBT	0.91999	2	0.45999	0.31962	0.726
SN BY PD	1.73102	2	0.86551	0.60138	0.548
YR BY CU	19.83418	8	2.47927	1.72267	0.088
YR BY BF	15.31561	8	1.91445	1.33021	0.223
YR BY OBT*	54.58400	4	13.64600	9.48161	0.000*
YR BY PD	15.21669	8	1.90209	1.32162	0.227
CU BY BF	11.15103	4	2.78776	1.93701	0.102
CU BY OBT	1.74168	2	0.87084	0.60508	0.546
CU BY PD*	92.61881	4	23.15470	16.08851	0.000*
BF BY OBT	5.94244	4	1.48561	1.03224	0.389
BF BY PD	10.27699	4	2.56925	1.78518	0.129
OBT BY PD*	23.27370	3	7.75790	5.39040	0.001*

Appendix Table 2. Detailed results of analysis of variance, tuna vessels, 1979-1983. Individual tables list results by school type (see text). Results summarized in Table 5. An Asterisk indicates significance at at least the 5% level.

A. School Type 1

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	5553.09502	4928	1.12685		
Constant	680.79210	1	680.79210	604.15740	0.000
Set*	11.78830	1	11.78830	10.46133	0.001*
AR	1.36933	2	0.68467	0.60759	0.545
SN	0.59942	1	0.59942	0.53195	0.466
YR	2.32772	4	0.58193	0.51642	0.724
CU	3.65866	2	1.82933	1.62341	0.197
BF	0.31476	2	0.15738	0.13966	0.870
PD	2.23417	2	1.11708	0.99134	0.371
CAP*	5.26070	1	5.26070	4.66852	0.031*
SET BY AR*	18.04043	2	9.02021	8.00484	0.000*
SET BY SN	0.02441	1	0.02441	0.02167	0.333
SET BY YR	4.75381	4	1.18845	1.05467	0.378
SET BY CU*	13.83083	2	6.91542	6.13697	0.002*
SET BY BF	1.09448	2	0.54724	0.48564	0.615
SET BY PD	6.20210	2	3.10105	2.75197	0.064
SET BY CAP	3.00533	1	3.00533	2.66703	0.103
AR BY SN	5.28637	2	2.64318	2.34565	0.096
AR BY YR*	32.02559	8	4.00320	3.55257	0.000*
AR BY CU	3.85038	4	0.96260	0.85424	0.491
AR BY BF	6.48222	4	1.62055	1.43813	0.219
AR BY PD	9.04617	4	2.26154	2.00697	0.091
AR BY CAP	6.45522	2	3.22761	2.86429	0.057
SN BY YR*	41.90478	4	10.47620	9.29692	0.000*
SN BY CU	1.14996	2	0.57498	0.51026	0.600
SN BY BF	3.74204	2	1.87102	1.66040	0.190
SN BY PD	3.92237	2	1.96118	1.74042	0.176
SN BY CAP	3.14650	1	3.14650	2.79231	0.095
YR BY CU	15.97734	8	1.99717	1.77235	0.077
YR BY BF	9.55690	8	1.19461	1.06014	0.388
YR BY PD*	18.25077	8	2.28135	2.02454	0.040*
YR BY CAP	9.70956	4	2.42739	2.15415	0.072
CU BY BF	0.71083	4	0.17771	0.15770	0.960
CU BY PD*	14.62854	4	3.65713	3.24546	0.012*
CU BY CAP	1.44222	2	0.72111	0.63994	0.527
BF BY PD*	13.25775	4	3.31444	2.94134	0.019*
BF BY CAP	2.76946	2	1.38473	1.22886	0.293
PF BY CAP	2.62930	2	1.31465	1.16666	0.312

[1]Abreviations defined in Table 3 and Appendix Table 1.

Appendix Table 2. Continued

B. School Type 2

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	432.10838	336	1.28604		
Constant	165.98186	1	165.98186	129.06463	0.000
Set*	6.11071	1	6.11071	4.75158	0.030*
AR	3.65958	2	1.82979	1.42281	0.242
SN	0.00729	1	0.00729	0.00567	0.940
YR	4.23735	4	1.05934	0.82372	0.511
CU	5.56194	2	2.78097	2.16244	0.117
BF	4.02617	2	2.01309	1.56534	0.211
PD*	12.55200	2	6.27600	4.88011	0.008*
CAP	2.94780	1	2.94780	2.29216	0.131
SET BY AR	1.05581	2	0.52790	0.41049	0.664
SET BY SN	1.02041	1	1.02041	0.79346	0.374
SET BY YR	2.62920	4	0.65730	0.51110	0.728
SET BY CU	1.32747	1	1.32747	1.03222	0.310
SET BY BF	0.87669	2	0.43834	0.34085	0.711
SET BY PD	0.04234	2	0.2117	0.01646	0.984
SET BY CAP	3.52342	1	3.52342	2.73975	0.099
AR BY SN	2.56412	2	1.28206	0.99691	0.370
AR BY YR*	23.11897	8	2.88987	2.24711	0.024*
AR BY CU	2.82482	3	0.94161	0.73218	0.533
AR BY BF	2.69685	4	0.67421	0.52426	0.718
AR BY PD	2.18474	4	0.54619	0.42470	0.791
AR BY CAP	4.76258	2	2.38129	1.85165	0.159
SN BY YR*	17.81800	4	4.45450	3.46374	0.009*
SN BY CU	0.49898	2	0.24949	0.19400	0.824
SN BY BF	1.92752	2	0.96376	0.74940	0.473
SN BY PD	0.73865	2	0.36933	0.28718	0.751
SN BY CAP	1.53355	1	1.53355	1.19246	0.276
YR BY CU	4.11605	5	0.82321	0.64011	0.669
YR BY BF	9.01061	8	1.12633	0.87581	0.537
YR BY PD	9.58387	8	1.19798	0.93153	0.490
YR BY CAP	4.64451	4	1.16113	0.90287	0.462
CU BY BF	3.00282	3	1.00094	0.77831	0.507
CU BY PD*	19.41519	2	9.70759	7.54846	0.001*
CU BY CAP	0.63721	1	0.63721	0.49549	0.482
BF BY PD	9.69001	4	2.42250	1.88370	0.113
BF BY CAP	5.53056	2	2.76528	2.15023	0.118
PF BY CAP	3.60343	2	1.80171	1.40098	0.248

Appendix Table 2. Continued

C. School Type 3

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	230.01475	229	1.00443		
Constant	18.97531	1	18.97531	18.89160	0.000
Set	0.16283	1	0.16283	0.16211	0.688
AR	4.03771	2	2.01885	2.00995	0.136
SN	0.09037	1	0.09037	0.08997	0.764
YR	0.61097	4	0.15274	0.15207	0.962
CU	0.61259	2	0.30629	0.30494	0.737
BF	0.95836	2	0.47918	0.47707	0.621
PD	0.59853	2	0.29927	0.29795	0.743
CAP	0.45616	1	0.45616	0.45415	0.501
SET BY AR	0.41851	1	0.41851	0.41666	0.519
SET BY SN	0.37009	1	0.37009	0.36846	0.544
SET BY YR	0.54940	2	0.27470	0.27349	0.761
SET BY CU	0.05276	1	0.05276	0.05253	0.819
SET BY BF	1.44033	1	1.44033	1.43398	0.232
SET BY PD	3.85320	2	1.92660	1.91810	0.149
SET BY CAP	1.08693	1	1.08693	1.08213	0.299
AR BY SN	1.04755	2	0.52377	0.52146	0.594
AR BY YR	7.35137	8	0.91492	0.91487	0.505
AR BY CU	3.15752	4	0.78938	0.78590	0.535
AR BY BF	2.41688	4	0.60422	0.60155	0.662
AR BY PD	9.06148	4	2.26537	2.25538	0.064
AR BY CAP	3.07101	2	1.53551	1.52873	0.219
SN BY YR	5.14229	4	1.28557	1.27990	0.279
SN BY CU	1.02987	2	0.51494	0.51266	0.600
SN BY BF*	7.83148	2	3.91574	3.89846	0.022
SN BY PD	3.68189	2	1.84094	1.83282	0.162
SN BY CAP	0.04868	1	0.04868	0.04846	0.826
YR BY CU	4.74314	6	0.79052	0.78704	0.581
YR BY BF	12.13311	8	1.51664	1.50995	0.155
YR BY PD	6.99909	8	0.87489	0.87103	0.542
YR BY CAP	4.70895	4	1.17724	1.17204	0.324
CU BY BF	1.72932	3	0.57644	0.57390	0.633
CU BY PD	2.91318	2	1.45659	1.45016	0.237
CU BY CAP	0.99807	1	0.99807	0.99367	0.320
BF BY PD	4.13771	4	1.03443	1.02986	0.393
BF BY CAP	0.40450	2	0.20225	0.20136	0.818
PF BY CAP	3.77305	2	1.88652	1.87820	0.155

Appendix Table 2. Continued

D. School Type 4

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	3124.44740	1595	1.95890		
Constant	369.09664	1	369.09664	188.42025	0.000
Set	0.05657	1	0.05657	0.02888	0.365
AR	9.74494	2	4.87247	2.48735	0.083
SN	0.12549	1	0.12549	0.06406	0.800
YR	12.84620	4	3.21155	1.63947	0.162
CU	0.05188	2	0.02594	0.01324	0.987
BF	1.54936	2	0.77468	0.39547	0.673
PD	2.56573	2	1.28287	0.65489	0.520
CAP	3.29705	1	3.29705	1.68311	0.195
SET BY AR	1.35868	2	0.67934	0.34680	0.707
SET BY SN	0.04120	1	0.04120	0.02103	0.885
SET BY YR	2.57098	4	0.64274	0.32811	0.859
SET BY CU	4.17947	2	2.08974	1.06679	0.344
SET BY BF	3.62075	2	1.81037	0.92418	0.397
SET BY PD	4.61244	2	2.30622	1.17730	0.308
SET BY CAP	5.31498	1	5.31498	2.71324	0.100
AR BY SN*	12.04598	2	6.02299	3.07468	0.046*
AR BY YR*	32.70750	8	4.08844	2.08711	0.034*
AR BY CU	12.87297	4	3.21824	1.64288	0.161
AR BY BF	2.70545	4	0.67636	0.34528	0.847
AR BY PD	2.63062	4	0.65766	0.33573	0.854
AR BY CAP*	18.11355	2	9.05677	4.62339	0.010*
SN BY YR*	48.17160	4	12.04290	6.14778	0.000*
SN BY CU*	17.40467	2	8.70233	4.44246	0.012*
SN BY BF	1.73714	2	0.86857	0.44340	0.642
SN BY PD	0.79575	2	0.39788	0.20311	0.816
SN BY CAP	0.42025	1	0.42025	0.21453	0.643
YR BY CU	10.92470	8	1.36559	0.69712	0.694
YR BY BF	15.94927	8	1.99366	1.01774	0.420
YR BY PD	11.88678	8	1.48585	0.75851	0.640
YR BY CAP*	38.54820	4	9.63705	4.91962	0.001*
CU BY BF	2.95827	4	0.73957	0.37754	0.825
CU BY PD	16.28702	4	4.07175	2.07859	0.081
CU BY CAP	4.88944	2	2.44472	1.24801	0.287
BF BY PD	14.01738	4	3.50434	1.78893	0.128
BF BY CAP	6.47979	2	3.23990	1.65394	0.192
PF BY CAP	1.34394	2	0.67197	0.34303	0.710

Appendix Table 2. Continued

E. School Type 5

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	967.31425	1188	0.81424		
Constant	198.36841	1	198.26841	243.50191	0.000
Set*	3.34663	1	3.34663	4.11014	0.043*
AR	0.98186	2	0.49093	0.60293	0.547
SN	2.83533	1	2.83533	3.48218	0.062
YR*	12.60083	4	3.15021	3.86890	0.004*
CU	3.13948	2	1.56974	1.92787	0.146
BF	0.44146	2	0.22073	0.27109	0.763
PD*	6.92515	2	3.46257	4.25253	0.014*
CAP	0.05770	1	0.05770	0.07087	0.790
SET BY AR*	6.24065	2	3.12032	3.83220	0.022*
SET BY SN	0.41339	1	0.41339	0.50770	0.476
SET BY YR	5.28466	4	1.32191	1.62350	0.166
SET BY CU	2.00325	1	2.00325	2.46028	0.117
SET BY BF	4.47067	2	2.23534	2.74531	0.065
SET BY PD	1.12684	2	0.56342	0.69196	0.501
SET BY CAP	2.55312	1	2.55312	3.13560	0.077
AR BY SN*	7.29815	2	3.64907	4.48158	0.012*
AR BY YR*	14.11921	8	1.76490	2.16755	0.028*
AR BY CU	1.48530	2	0.74265	0.91208	0.402
AR BY BF	1.51395	4	0.37849	0.46484	0.762
AR BY PD	6.44279	4	1.61070	1.97817	0.096
AR BY CAP	0.00526	2	0.00263	0.00323	0.997
SN BY YR*	11.51217	4	2.87804	3.53465	0.007*
SN BY CU	2.41927	1	2.41927	2.97121	0.085
SN BY BF	2.66010	2	1.33005	1.63349	0.196
SN BY PD	2.59919	2	1.29960	1.59609	0.203
SN BY CAP	1.11130	1	1.11130	1.36483	0.243
YR BY CU	6.80717	4	1.70179	2.09005	0.080
YR BY BF	8.78457	8	1.09807	1.34859	0.215
YR BY PD	10.15920	8	1.26990	1.55962	0.132
YR BY CAP	4.57778	4	1.14444	1.40554	0.230
CU BY BF	0.56690	2	0.28345	0.34812	0.706
CU BY PD*	5.06633	2	2.53317	3.11109	0.045*
CU BY CAP	0.00556	1	0.00556	0.00683	0.934
BF BY PD	5.20346	4	1.30086	1.59765	0.173
BF BY CAP	0.23719	2	0.11860	0.14565	0.264
PF BY CAP	1.84945	2	0.92473	1.13570	0.322

Appendix Table 2. Continued

F. School Type 6

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	201.41723	174	1.15757		
Constant	306.86495	1	306.86495	265.09400	0.000
Set*	5.38017	1	5.38017	4.64782	0.032*
AR	6.35478	2	3.17739	2.74488	0.067
SN	0.01782	1	0.01782	0.01539	0.901
YR	2.43710	4	0.60928	0.52634	0.717
CU	1.66325	2	0.83163	0.71842	0.489
BF	1.52745	2	0.76372	0.65977	0.518
PD	1.75874	2	0.87937	0.75967	0.469
CAP	0.09228	1	0.09228	0.07972	0.778
SET BY AR	0.80601	2	0.40300	0.34815	0.706
SET BY SN	0.00600	1	0.00600	0.00518	0.943
SET BY YR	4.02549	4	1.00637	0.86938	0.484
SET BY CU	1.66371	2	0.83186	0.71862	0.489
SET BY BF	0.62354	2	0.31177	0.26933	0.764
SET BY PD	2.99252	2	1.49626	1.29259	0.277
SET BY CAP	0.51886	1	0.51886	0.44823	0.504
AR BY SN	0.89411	2	0.44706	0.38620	0.680
AR BY YR	17.44305	8	2.18038	1.88358	0.065
AR BY CU	1.35461	2	0.67731	0.58511	0.558
AR BY BF	3.56840	4	0.89210	0.77067	0.546
AR BY PD	5.60205	4	1.40051	1.20987	0.308
AR BY CAP	1.66718	2	0.83359	0.72012	0.488
SN BY YR	3.99526	4	0.99882	0.86286	0.437
SN BY CU	0.59526	2	0.29763	0.25711	0.774
SN BY BF	3.68424	2	1.84212	1.59137	0.207
SN BY PD	2.07504	2	1.03752	0.89629	0.410
SN BY CAP	0.55541	1	0.55541	0.47981	0.489
YR BY CU	2.18670	4	0.54668	0.47226	0.756
YR BY BF	10.56989	8	1.32124	1.14139	0.338
YR BY PD	11.49807	8	1.43726	1.24162	0.278
YR BY CAP	4.98130	4	1.24533	1.07581	0.370
CU BY BF	2.05274	2	1.02637	0.88666	0.414
CU BY PD	0.94848	2	0.47424	0.40968	0.664
CU BY CAP	0.64174	1	0.64174	0.55439	0.458
BF BY PD	1.11749	4	0.27937	0.24134	0.915
BF BY CAP	1.83907	2	0.91953	0.79436	0.454
PF BY CAP	0.66518	2	0.33259	0.28732	0.751

Appendix Table 2. Continued

G. School Type 7

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	5134.22311	3507	1.46399		
Constant	175.97140	1	175.97140	120.19963	0.000
Set	0.55035	1	0.55035	0.37592	0.540
AR*	19.07442	2	9.53721	6.51452	0.002*
SN	4.33129	1	4.33129	2.95854	0.086
YR*	16.55889	4	4.13972	2.82769	0.024*
CU	3.50920	2	1.75460	1.19850	0.302
BF	2.50065	2	1.25033	0.85405	0.426
PD	7.34287	2	3.67143	2.50782	0.082
CAP	0.15036	1	0.15036	0.10271	0.749
SET BY AR	7.27773	2	3.63887	2.48558	0.084
SET BY SN	4.29584	1	4.29584	2.93433	0.087
SET BY YR*	13.96536	4	3.49134	2.38481	0.049*
SET BY CU	0.00145	1	0.00145	0.00099	0.975
SET BY BF	1.84341	2	0.92171	0.62958	0.533
SET BY PD	0.99151	2	0.49576	0.33863	0.713
SET BY CAP	0.00477	1	0.00477	0.00326	0.955
AR BY SN	6.59990	2	3.29995	2.25407	0.105
AR BY YR*	28.59545	8	3.57443	2.44156	0.012*
AR BY CU*	40.42611	4	10.10653	6.90340	0.000*
AR BY BF	8.86543	4	2.21636	1.51391	0.195
AR BY PD*	15.09475	4	3.77369	2.57767	0.036*
AR BY CAP*	12.33686	2	6.16843	4.21343	0.015*
SN BY YR	11.71744	4	2.92936	2.00094	0.092
SN BY CU	1.28097	2	0.64048	0.43749	0.646
SN BY BF	1.84486	2	0.92243	0.63008	0.533
SN BY PD	3.02698	2	1.51349	1.03381	0.356
SN BY CAP	1.47339	1	1.47339	1.00642	0.316
YR BY CU	16.15766	8	2.01971	1.37959	0.200
YR BY BF	14.61916	8	1.82739	1.24823	0.266
YR BY PD	14.51258	8	1.81407	1.23913	0.271
YR BY CAP*	17.89605	4	4.47401	3.05604	0.016*
CU BY BF	7.62496	4	1.90624	1.30208	0.267
CU BY PD*	87.56238	4	21.89059	14.95266	0.000*
CU BY CAP	0.90078	2	0.45039	0.30765	0.735
BF BY PD	8.93512	4	2.23378	1.52581	0.192
BF BY CAP	1.24413	2	0.62206	0.42491	0.654
PD BY CAP	0.91617	2	0.45808	0.31290	0.713

Appendix Table 3. Results of analysis of variance, research vessels, 1979-1983. Individual tables list results by school type (see text). Results are summarized in Table 6. An asterisk indicates significance at at least the 5% level.

A. School Type 1

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	135.57826	152	0.89196		
Constant	11.89625	1	11.88625	13.32596	0.000
AR	1.67372	2	0.83686	0.93822	0.394
SN	0.57629	1	0.57629	0.64610	0.423
YR	2.75047	4	0.68762	0.77090	0.546
CU	0.87144	1	0.87144	0.97699	0.325
BF	1.46267	2	0.73133	0.81992	0.442
PD	1.81442	2	0.90721	1.01709	0.364
AR BY SN	0.80310	2	0.40155	0.45019	0.638
AR BY YR*	14.47292	8	1.80911	2.02824	0.047*
AR BY CU	0.20964	2	0.10482	0.11751	0.889
AR BY BF	0.60584	4	0.15146	0.16980	0.954
AR BY PD	3.97489	4	0.99372	1.11409	0.352
SN BY YR	2.99405	2	1.49702	1.67835	0.190
SN BY CU	0.88721	1	0.88721	0.99467	0.320
SN BY BF	1.57859	2	0.78929	0.88489	0.415
SN BY PD	0.74693	2	0.37347	0.41870	0.659
YR BY CU*	10.90970	4	2.72743	3.05778	0.019*
YR BY BF	3.88003	6	0.64667	0.72500	0.630
YR BY PD	11.14726	7	1.59247	1.78535	0.084
CU BY BF	0.55270	2	0.27635	0.30982	0.734
CU BY PD	0.86288	2	0.43144	0.48370	0.617
BF BY PD	5.42970	4	1.35742	1.52184	0.199

[1]Abbreviations defined in Table 3 and Appendix Table 1.

Appendix Table 3. Continued

B. School Type 2

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	6.55893	14	0.46849		
Constant	21.76296	1	21.76296	46.45291	0.000
AR*	4.09249	2	2.04625	4.36770	0.034*
SN	1.25796	1	1.25796	2.68511	0.124
YR*	9.26917	4	2.31729	4.94625	0.011*
CU*	6.91697	1	6.91697	14.76422	0.002*
BF	1.32175	2	0.66087	1.41063	0.277
PD	0.72064	2	0.36032	0.76910	0.482
AR BY SN	0.09975	1	0.09975	0.21291	0.652
AR BY YR	2.81047	4	0.70262	1.49973	0.255
AR BY CU*	4.48021	2	2.24010	4.78149	0.026*
AR BY BF*	3.68103	2	1.84051	3.92857	0.044*
AR BY PD	2.81865	2	1.40933	3.00820	0.082
SN BY YR	0.10754	1	0.10754	0.22953	0.128
SN BY CU*	10.02232	1	10.02232	21.39359	0.000*
SN BY BF	2.75146	2	1.37573	2.93649	0.086
SN BY PD*	6.61372	2	3.30686	7.05848	0.008*
YR BY CU*	11.73146	3	3.91049	8.34691	0.002*
YR BY BF*	0.00000	0	0.00000	0.00000	0.000*
YR BY PD*	11.46575	2	5.73288	12.23679	0.001*
CU BY BF	0.01791	1	0.01791	0.03823	0.843
CU BY PD*	0.00000	0	0.00000	0.00000	0.000*
BF BY PD*	0.00000	0	0.00000	0.00000	0.000*

Appendix Table 3. Continued

C. School Type 3

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	23.49441	78	0.30121		
Constant	0.01292	1	0.01292	0.04288	0.836
AR	0.24521	1	0.12260	0.40704	0.667
SN	0.11282	1	0.11282	0.37457	0.542
YR	0.99940	4	0.24985	0.82949	0.510
CU*	2.13399	2	1.06699	3.54235	0.034*
BF	0.09395	2	0.04698	0.15596	0.856
PD	0.62363	2	0.31182	1.03521	0.360
AR BY SN	0.02554	2	0.01277	0.04240	0.959
AR BY YR	2.53319	7	0.36188	1.20143	0.312
AR BY CU*	2.43113	1	2.43113	8.07121	0.006*
AR BY BF	0.70783	4	0.17696	0.58748	0.673
AR BY PD	0.95716	4	0.23929	0.79443	0.532
SN BY YR	0.01295	1	0.01295	0.04298	0.836
SN BY CU	1.09557	1	1.09557	3.63724	0.060
SN BY BF	0.27091	2	0.13546	0.44970	0.639
SN BY PD	1.69370	2	0.84685	2.81149	0.066
YR BY CU*	1.88310	1	1.88310	6.25178	0.015*
YR BY BF	2.60367	7	0.37195	1.23486	0.294
YR BY PD	2.52159	7	0.36023	1.19593	0.315
CU BY BF*	0.00000	0	0.00000	0.00000	0.000*
CU BY PD*	0.00000	0	0.00000	0.00000	0.000*
BF BY PD	2.55494	4	0.63873	2.12056	0.086

Appendix Table 3. Continued

D. School Type 4

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	94.37105	99	0.95324		
Constant	38.88950	1	38.88950	40.79705	0.000
AR	0.20455	2	0.10227	0.10729	0.898
SN	3.10350	1	3.10350	3.25573	0.074
YR	3.56212	4	0.89053	0.93421	0.447
CU	0.38922	2	0.19461	0.20416	0.816
BF	0.55465	2	0.27732	0.29093	0.748
PD	4.38882	2	2.19441	2.30205	0.105
AR BY SN	4.20256	2	2.10128	2.20435	0.116
AR BY YR	2.92454	2	1.46227	1.53400	0.221
AR BY CU	1.23091	2	0.61546	0.64564	0.527
AR BY BF	4.10671	4	1.02668	1.07704	0.372
AR BY PD	6.17350	3	2.05783	2.15877	0.098
SN BY YR	0.81438	3	0.27146	0.28478	0.836
SN BY CU	4.53350	2	2.26675	2.37793	0.098
SN BY BF	4.15078	2	2.07539	2.17719	0.119
SN BY PD	1.60719	2	0.80359	0.84301	0.433
YR BY CU	2.77329	3	0.92443	0.96977	0.410
YR BY BF*	16.74722	8	2.09340	2.19609	0.034**
YR BY PD	4.50962	7	0.64423	0.67583	0.692
CU BY BF	1.05958	2	0.52979	0.55578	0.575
CU BY PD	1.99311	2	0.99656	1.04544	0.355
BF BY PD	3.19338	4	0.79834	0.83750	0.505

Appendix Table 3. Continued

E. School Type 5

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	32.73866	63	0.51950		
Constant	9.76942	1	9.76942	18.80534	0.000
AR	1.51507	2	0.75753	1.45819	0.240
SN	0.12039	1	0.12039	0.23174	0.632
YR	2.11475	4	0.52869	1.01768	0.405
CU	0.81016	2	0.40508	0.77975	0.463
BF	2.23752	2	1.11876	2.15352	0.125
PD	0.13140	2	0.06570	0.12647	0.881
AR BY SN	0.62400	2	0.31200	0.60058	0.552
AR BY YR	2.97328	5	0.59466	1.14467	0.346
AR BY CU	0.80504	2	0.40252	0.77482	0.465
AR BY BF*	6.79433	3	2.26478	4.35951	0.007*
AR BY PD	3.68376	4	0.92094	1.77273	0.145
SN BY YR	0.38480	1	0.38480	0.74070	0.393
SN BY CU	0.86011	1	0.86011	1.65565	0.203
SN BY BF	0.39244	1	0.39244	0.75541	0.388
SN BY PD	0.51719	2	0.25860	0.49778	0.610
YR BY CU	0.94885	2	0.47442	0.91323	0.406
YR BY BF*	6.96334	5	1.39267	2.68077	0.029*
YR BY PD	0.17272	4	0.04318	0.08312	0.927
CU BY BF	0.51100	2	0.25550	0.49181	0.614
CU BY PD	0.23764	2	0.11082	0.22872	0.796
BF BY PD	0.82777	4	0.20694	0.39835	0.809

Appendix Table 3. Continued

F. School Type 6

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	41.05687	36	1.14047		
Constant	16.07261	1	16.07261	14.09299	0.001
AR	0.75109	2	0.37554	0.32929	0.722
SN	2.72525	1	2.72525	2.38958	0.131
YR	7.30987	4	1.82747	1.60238	0.195
CU	0.59404	1	0.59404	0.52087	0.475
BF	0.34047	2	0.17023	0.14927	0.362
PD	0.70100	2	0.35050	0.30733	0.737
AR BY SN	0.47861	1	0.47861	0.41966	0.521
AR BY YR	4.30061	3	1.43354	1.25697	0.304
AR BY CU	1.99564	1	1.99564	1.74984	0.194
AR BY BF	1.30848	2	0.65424	0.57366	0.569
AR BY PD	2.93963	3	0.97988	0.85919	0.471
SN BY YR	0.14031	1	0.14031	0.12302	0.728
SN BY CU	0.89155	1	0.89155	0.78174	0.382
SN BY BF	0.28607	2	0.14303	0.12542	0.883
SN BY PD	2.41362	2	1.20681	1.05817	0.358
YR BY CU	1.51844	3	0.50615	0.44381	0.723
YR BY BF	2.35767	5	0.47153	0.41346	0.836
YR BY PD	0.96370	2	0.48185	0.42250	0.659
CU BY BF	0.62635	2	0.31318	0.27460	0.761
CU BY PD	4.21016	2	2.-0508	1.84580	0.173
BF BY PD	2.45217	4	0.61304	0.53754	0.709

ppendix Table 3. Continued

. School Type 7

ource of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
ithin Cells	192.38672	208	0.92494		
onstant	80.30672	1	80.30672	86.82407	0.000
AR	0.19690	2	0.09845	0.10644	0.899
SN	0.39399	1	0.39399	0.42597	0.515
YR	4.26652	4	1.06663	1.15319	0.333
CU	1.06275	2	0.53137	0.57450	0.564
BF	0.68028	2	0.34014	0.36775	0.693
PD	0.13713	2	0.06856	0.07413	0.929
AR BY SN*	6.25240	2	3.12620	3.37991	0.036*
AR BY YR	8.47862	8	1.05983	1.14584	0.334
AR BY CU	1.74889	4	0.43722	0.47270	0.756
AR BY BF	4.85903	4	1.21476	1.31334	0.266
AR BY PD	3.56803	4	0.89201	0.96440	0.428
SN BY YR	2.17521	2	1.08760	1.17587	0.311
SN BY CU	0.17718	2	0.08859	0.09578	0.909
SN BY BF	0.48572	2	0.24286	0.26257	0.769
SN BY PD	1.94136	2	0.97068	1.04945	0.352
YR BY CU	0.71024	7	0.10146	0.10970	0.998
YR BY BF	4.19378	8	0.52422	0.56677	0.804
YR BY PD	5.18515	8	0.64814	0.70074	0.691
CU BY BF	3.49801	4	0.87325	0.94412	0.439
CU BY PD	2.91290	4	0.72823	0.78732	0.535
BF BY PD	0.41984	4	0.10496	0.11348	0.978

Appendix Table 4. Results of analysis of variance, tuna vessels, research vessels, aircraft, 1977-1983. Individual tables list results by school type (see text). Results are summarized in Table 7. An asterisk indicates significance at at least the 5% level.

A. School Type 1

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cell	11356.16330	8204	1.38422		
Constant	185.10376	1	185.10376	133.72397	0.000
AR	0.77992	2	0.38996	0.28172	0.755
SN	0.01506	1	0.01506	0.01088	0.917
YR	11.35456	6	1.89243	1.36714	0.224
CU*	11.13103	2	5.56551	4.02068	0.018*
OBT*	27.85731	2	13.92866	10.06244	0.000*
PD	2.60779	2	1.30390	0.94197	0.390
AR BY SN	6.55689	2	3.27845	2.36844	0.094
AR BY YR	22.48459	12	1.87372	1.35362	0.181
AR BY CU*	19.26449	4	4.81612	3.47930	0.008*
AR BY OBT	1.58449	4	0.39612	0.28617	0.887
AR BY PD	4.57863	4	1.14466	0.82693	0.508
SN BY YR*	63.09217	6	10.51536	7.59658	0.000*
SN BY CU	0.29955	2	0.14977	0.10820	0.897
SN BY OBT	5.81600	2	2.90800	2.10082	0.123
SN BY PD	0.35770	2	0.17885	0.12921	0.879
YR BY CU*	44.80194	12	3.73349	2.69718	0.001*
YR BY OBT*	48.21149	6	8.03525	5.80488	0.000*
YR BY PD	27.56672	12	2.29723	1.65958	0.069
CU BY OBT	2.21478	1	2.21478	1.60002	0.206
CU BY PD*	65.46610	4	16.36652	11.82362	0.000*
OBT BY PD	2.36955	4	0.59239	0.42796	0.789

[1]Abbreviations defined in Table 3 and Appendix Table 1.

Appendix Table 4. Continued

B. School Type 2

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	1212.19530	912	1.32916		
Constant	67.74848	1	67.74848	50.97084	0.000
AR	4.84756	2	2.42378	1.82354	0.162
SN	3.35999	1	3.35999	2.52790	0.112
YR	6.82571	6	1.13762	0.85589	0.527
CU	0.30756	2	0.15378	0.11570	0.891
OBT	4.90385	2	2.45193	1.84472	0.159
PD	0.66868	2	0.33434	0.25154	0.778
AR BY SN	7.60295	2	3.80148	2.86006	0.058
AR BY YR	26.12733	12	2.17728	1.63808	0.076
AR BY CU	7.85028	3	2.61676	1.96873	0.117
AR BY OBT	4.99212	3	1.66404	1.25195	0.290
AR BY PD	14.68749	4	3.67187	2.76255	0.027
SN BY YR*	23.10776	5	4.62155	3.47704	0.004*
SN BY CU	0.29927	2	0.14964	0.11258	0.894
SN BY OBT	5.01696	2	2.50848	1.88727	0.152
SN BY PD	2.46629	2	1.23314	0.92776	0.396
YR BY CU	2.80278	7	0.40040	0.30124	0.953
YR BY OBT	17.18070	5	3.43614	2.58519	0.025
YR BY PD	15.22996	12	1.26916	0.95486	0.491
CU BY OBT	3.38932	1	3.38932	2.54997	0.111
CU BY PD*	39.06696	4	9.76674	7.34805	0.000*
OBT BY PD	3.86998	4	0.96750	0.72790	0.573

Appendix Table 4. Continued

C. School Type 3

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	521.48105	567	0.91972		
Constant	2.23864	1	2.23864	2.43404	0.119
AR	3.54006	2	1.77003	1.92453	0.147
SN	0.06389	1	0.06389	0.06947	0.792
YR	7.30364	6	1.21727	1.32353	0.244
CU	0.66347	2	0.33174	0.36069	0.697
OBT	1.98395	2	0.99198	1.07856	0.341
PD	1.93414	2	0.96707	1.05148	0.350
AR BY SN	1.44055	2	0.72027	0.78314	0.457
AR BY YR*	26.48622	12	2.20718	2.39985	0.005*
AR BY CU	7.42572	4	1.85643	2.01847	0.090
AR BY OBT	8.75437	4	2.18859	2.37963	0.051
AR BY PD	8.48291	4	2.12073	2.30584	0.057
SN BY YR	10.17855	6	1.69643	1.84450	0.088
SN BY CU	0.36480	2	0.18240	0.19832	0.820
SN BY OBT	0.01356	1	0.01356	0.01475	0.903
SN BY PD*	6.59157	2	3.29579	3.58347	0.028*
YR BY CU	4.01935	9	0.44659	0.48558	0.885
YR BY OBT	12.48337	7	1.78334	1.93900	0.061
YR BY PD	8.91390	12	0.74282	0.80766	0.643
CU BY OBT	0.49018	2	0.24509	0.26648	0.766
CU BY PD	7.12986	3	2.37662	2.58407	0.052
OBT BY PD*	12.88472	3	4.29491	4.66980	0.003*

Appendix Table 4. Continued

D. School Type 4

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	5417.08173	2895	1.87119		
Constant	176.40938	1	176.40938	94.27681	0.000
AR*	14.29316	2	7.14658	3.81928	0.022*
SN	1.70201	1	1.70201	0.90959	0.340
YR	11.79688	6	1.96615	1.05075	0.390
CU	0.18784	2	0.09392	0.05019	0.951
OBT	10.15526	2	5.07763	2.71359	0.067
PD	7.82819	2	3.91410	2.09177	0.124
AR BY SN*	19.80123	2	9.90061	5.29109	0.005*
AR BY YR	37.20297	12	3.10025	1.65684	0.070
AR BY CU*	32.68484	4	8.17121	4.36686	0.002*
AR BY OBT	4.58689	4	1.14672	0.61283	0.653
AR BY PD	10.14924	4	2.53731	1.35599	0.247
SN BY YR*	43.90207	6	7.31701	3.91036	0.001*
SN BY CU*	28.23311	2	14.11656	7.54418	0.001*
SN BY OBT	1.20477	2	0.60238	0.32193	0.725
SN BY PD	1.00411	2	0.50206	0.26831	0.765
YR BY CU	33.00208	12	2.75017	1.46975	0.128
YR BY OBT*	37.00213	7	5.28602	2.82496	0.006*
YR BY PD	23.12659	12	1.92722	1.02994	0.418
CU BY OBT	1.39442	2	0.69721	0.37260	0.689
CU BY PD*	36.55941	4	9.13985	4.88453	0.001*
OBT BY PD	6.45258	4	1.61314	0.86210	0.486

Appendix Table 4. Continued

E. School Type 5

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	2284.64050	2465	0.92683		
Constant	39.22799	1	39.22799	42.32482	0.000
AR	1.47545	2	0.73772	0.79596	0.451
SN*	3.83246	1	3.83246	4.13501	0.042*
YR*	17.71751	6	2.95292	3.18603	0.004*
CU	3.22244	2	1.61122	1.73842	0.176
OBT*	22.62617	2	11.31309	12.20619	0.000*
PD	0.47522	2	0.23761	0.25637	0.774
AR BY SN*	9.43359	2	4.71680	5.08916	0.006*
AR BY YR*	31.49213	12	2.62434	2.83152	0.001*
AR BY CU	5.14080	3	1.71360	1.84888	0.136
AR BY OBT	4.64926	3	1.54975	1.67210	0.171
AR BY PD	3.47454	4	0.86863	0.93721	0.441
SN BY YR	15.36577	6	2.56096	2.76313	0.011
SN BY CU*	3.57785	1	3.57785	3.86030	0.050*
SN BY OBT*	7.55479	1	7.55479	8.15119	0.004*
SN BY PD	0.00669	2	0.00334	0.00361	0.996
YR BY CU	12.80738	6	2.13456	2.30307	0.032
YR BY OBT*	38.01549	5	7.60310	8.20332	0.000*
YR BY PD	15.02416	12	1.25201	1.35085	0.183
CU BY OBT	0.51685	1	0.51685	0.55765	0.455
CU BY PD*	12.38812	2	6.19406	6.68305	0.001*
OBT BY PD	4.56304	3	1.52101	1.64109	0.178

Appendix Table 4. Continued

F. School Type 6

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	633.85319	524	1.20964		
Constant	27.31873	1	27.31873	22.58411	0.000
AR	1.06327	2	0.53163	0.43950	0.645
SN	3.00920	1	3.00920	2.48767	0.115
YR*	17.82815	6	2.97136	2.45639	0.024*
CU	2.59704	2	1.29852	1.07347	0.343
OBT*	24.07771	2	12.03886	9.95240	0.000*
PD*	16.20858	2	8.10429	6.69973	0.001*
AR BY SN	1.86230	2	0.93115	0.76977	0.464
AR BY YR	23.18929	12	1.93244	1.59753	0.088
AR BY CU	3.34553	4	0.83638	0.69143	0.598
AR BY OBT	1.57795	2	0.78898	0.65224	0.521
AR BY PD	7.17448	4	1.79362	1.48277	0.206
SN BY YR	7.45445	6	1.24241	1.02709	0.407
SN BY CU	0.57954	2	0.28977	0.23955	0.787
SN BY OBT*	4.86260	1	4.86260	4.01986	0.045*
SN BY PD	1.03944	2	0.51972	0.42965	0.651
YR BY CU	4.33047	7	0.61864	0.51142	0.826
YR BY OBT*	19.61080	5	3.92216	3.24241	0.007*
YR BY PD	19.47274	12	1.62273	1.34149	0.191
CU BY OBT	0.97822	1	0.97822	0.80869	0.369
CU BY PD	1.57676	2	0.78838	0.65175	0.522
OBT BY PD	4.56565	2	2.28282	1.88719	0.153

Appendix Table 4. Continued

G. School Type 7

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	8937.31246	5876	1.52099		
Constant	470.95887	1	470.95887	309.64055	0.000
AR	7.57610	2	3.78805	2.49052	0.083
SN	1.03375	1	1.03375	0.67966	0.410
YR	13.69150	6	2.28192	1.50029	0.174
CU	4.18788	2	2.09394	1.37670	0.253
OBT*	58.89410	2	29.44705	19.36050	0.000*
PD*	16.74315	2	8.37157	5.50405	0.004*
AR BY SN	6.75798	2	3.37899	2.22158	0.109
AR BY YR*	38.95932	12	3.24661	2.13454	0.012*
AR BY CU*	56.35604	4	14.08901	9.26308	0.000*
AR BY OBT	0.57914	4	0.14478	0.09519	0.984
AR BY PD*	16.81866	4	4.20467	2.76443	0.026*
SN BY YR	5.84459	6	0.97410	0.64044	0.698
SN BY CU	0.44795	2	0.22398	0.14726	0.863
SN BY OBT	1.33932	2	0.66966	0.44028	0.644
SN BY PD	3.85807	2	1.92903	1.26828	0.282
YR BY CU	28.07825	12	2.33985	1.53838	0.103
YR BY OBT*	62.26307	7	8.89472	5.84800	0.000*
YR BY PD	25.13663	12	2.09472	1.37721	0.169
CU BY OBT	1.05963	2	0.52981	0.34834	0.706
CU BY PD*	135.16911	4	33.79228	22.21735	0.000*
OBT BY PD*	27.34697	4	6.83674	4.49494	0.001*

Appendix Table 5. Results of analysis of variance, tuna vessels, 1977-1983. Individual tables list results by school type (see text). Results are summarized in Table 8. An asterisk indicates significance at at least the 5% level.

A. School Type 1

Source of Variation[1]	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	9011.88582	7470	1.20641		
Constant	2774.13996	1	2774.13996	2299.49934	0.000
SET*	23.59722	1	23.59722	19.55986	0.000*
AR	4.97121	2	2.48560	2.06033	0.128
SN	0.03061	1	0.03061	0.02537	0.873
YR	6.84263	6	1.14044	0.94531	0.461
CU*	18.84352	2	9.42176	7.80975	0.000*
PD	5.37700	2	2.68850	2.22851	0.108
CAP*	6.08784	1	6.08784	5.04624	0.025*
SET BY AR*	36.86705	2	18.43353	15.27965	0.000*
SET BY SN	0.01565	1	0.01565	0.01297	0.909
SET BY YR*	29.84700	6	4.97450	4.12339	0.000*
SET BY CU*	22.17516	2	11.08758	9.19055	0.000*
SET BY PD	3.36120	2	1.68060	1.39306	0.249
SET BY CAP	3.77069	1	3.77069	3.12555	0.077
AR BY SN	1.43602	2	0.71801	0.59516	0.552
AR BY YR	24.61057	12	2.05088	1.69999	0.060
AR BY CU	10.16525	4	2.54131	2.10651	0.078
AR BY PD*	11.56379	4	2.89095	2.39632	0.048*
AR BY CAP*	15.89924	2	7.94962	6.58948	0.001*
SN BY YR*	48.83243	6	8.13874	6.74624	0.000*
SN BY CU	2.78597	2	1.39299	1.15465	0.315
SN BY PD	2.64670	2	1.32335	1.09693	0.334
SN BY CAP	3.77307	1	3.77307	3.12752	0.077
YR BY CU*	25.78245	12	2.14854	1.78093	0.045*
YR BY PD	23.08766	12	1.92397	1.59479	0.086
YR BY CAP*	43.30371	6	7.21728	5.98245	0.000*
CU BY PD*	17.94299	4	4.48575	3.71826	0.005*
CU BY CAP	2.03817	2	1.01908	0.84472	0.430
PD BY CAP	6.80187	2	3.40094	2.81906	0.060

[1]Abbreviations defined in Table 3 and Appendix Table 1.

Appendix Table 5. Continued

B. School Type 2

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	921.71801	692	1.33196		
Constant	291.16493	1	291.16493	218.59846	0.000
SET*	5.87899	1	5.87899	4.41378	0.036*
AR	3.48170	2	1.74085	1.30698	0.271
SN	0.02203	1	0.02203	0.01654	0.898
YR	6.89411	6	1.14902	0.86265	0.522
CU	2.23740	2	1.11870	0.83989	0.432
PD	1.98096	2	0.99048	0.74362	0.476
CAP	1.23652	1	1.23652	0.92835	0.336
SET BY AR	0.36139	2	0.18069	0.13566	0.873
SET BY SN	3.67800	1	3.67800	2.76134	0.097
SET BY YR	4.81096	6	0.80183	0.60190	0.729
SET BY CU	0.45196	1	0.45196	0.33932	0.560
SET BY PD	0.70787	2	0.35393	0.26572	0.767
SET BY CAP	1.51285	1	1.51285	1.13580	0.287
AR BY SN	7.69329	2	3.84665	2.88795	0.056
AR BY YR*	28.34057	12	2.36171	1.77311	0.049*
AR BY CU	7.40840	3	2.46947	1.85401	0.126
AR BY PD	10.28888	4	2.57222	1.93115	0.103
AR BY CAP	3.76265	2	1.88133	1.41245	0.244
SN BY YR*	18.92795	5	3.78559	2.84211	0.015*
SN BY CU	0.17719	2	0.08860	0.06652	0.936
SN BY PD	1.52706	2	0.76353	0.57324	0.564
SN BY CAP	0.38752	1	0.38752	0.29094	0.590
YR BY CU	4.79339	7	0.68477	0.51411	0.824
YR BY PD	15.93040	12	1.32753	0.99667	0.450
YR BY CAP	14.73480	6	2.45580	1.84375	0.088
CU BY PD*	29.04029	4	7.26007	5.45066	0.000*
CU BY CAP	0.00033	1	0.00033	0.00025	0.987
PD BY CAP	1.90537	2	0.95268	0.71525	0.489

Appendix Table 5. Continued

C. School Type 3

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	405.79854	396	1.02474		
Constant	4.37058	1	4.37058	4.26505	0.040
SET	0.00495	1	0.00495	0.00483	0.945
AR*	7.47104	2	3.73552	3.64532	0.027*
SN	0.00220	1	0.00220	0.00215	0.963
YR	6.22320	6	1.03720	1.01216	0.417
CU	2.50889	2	1.25444	1.22415	0.295
PD	0.63633	2	0.31817	0.31048	0.733
CAP	0.49455	1	0.49455	0.48260	0.488
SET BY AR	2.63542	1	2.63542	2.57179	0.110
SET BY SN	0.03515	1	0.03515	0.03431	0.853
SET BY YR	3.44660	4	0.86165	0.84084	0.500
SET BY CU	0.40032	1	0.40032	0.39065	0.532
SET BY PD	2.37446	2	1.18723	1.15856	0.315
SET BY CAP	0.76465	1	0.76465	0.74619	0.388
AR BY SN	1.95948	2	0.97974	0.95608	0.385
AR BY YR	18.54263	12	1.54522	1.50791	0.118
AR BY CU	5.01394	4	1.25349	1.22322	0.300
AR BY PD*	10.24818	4	2.56205	2.50018	0.042*
AR BY CAP	0.93831	2	0.46915	0.45782	0.633
SN BY YR	9.43395	6	1.57233	1.53436	0.166
SN BY CU	0.53158	2	0.26579	0.25937	0.772
SN BY PD	3.02595	2	1.51297	1.47644	0.230
SN BY CAP	0.00237	1	0.00237	0.00232	0.962
YR BY CU	3.71649	9	0.41294	0.40297	0.933
YR BY PD	8.55243	12	0.71270	0.69549	0.756
YR BY CAP*	13.76704	6	2.29451	2.23910	0.039*
CU BY PD	4.95576	3	1.65192	1.61203	0.186
CU BY CAP	0.40011	1	0.40011	0.39045	0.532
PD BY CAP	0.09163	2	0.04582	0.04471	0.956

Appendix Table 5. Continued

D. School Type 4

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	4728.49818	2518	1.87788		
Constant	1078.77954	1	1078.77954	574.46715	0.000
SET	2.84980	1	2.84980	1.51756	0.218
AR*	24.81206	2	12.40603	6.60641	0.001*
SN	3.84888	1	3.84888	2.04959	0.152
YR	15.32760	6	2.55460	1.36036	0.227
CU	0.55603	2	0.27802	0.14805	0.862
PD*	12.18036	2	6.09018	3.24312	0.039*
CAP	4.54036	1	4.54036	2.41781	0.120
SET BY AR	1.31504	2	0.65752	0.35014	0.705
SET BY SN	0.14239	1	0.14239	0.07582	0.783
SET BY YR	3.02820	6	0.50470	0.26876	0.952
SET BY CU*	11.60446	2	5.80223	3.08978	0.046*
SET BY PD	3.10982	2	1.55491	0.82801	0.437
SET BY CAP	2.34487	1	2.34487	1.24868	0.264
AR BY SN*	17.97069	2	8.98534	4.77884	0.008*
AR BY YR*	44.87743	12	3.73979	1.99147	0.021*
AR BY CU*	19.79385	4	4.94846	2.63513	0.033*
AR BY PD	5.73446	4	1.43361	0.76342	0.549
AR BY CAP	6.56086	2	3.28043	1.74688	0.175
SN BY YR*	57.87036	6	9.64506	5.13615	0.000*
SN BY CU*	23.88848	2	11.94424	6.36050	0.002*
SN BY PD	1.11903	2	0.55952	0.29795	0.742
SN BY CAP	0.03874	1	0.03874	0.02063	0.886
YR BY CU	27.28802	12	2.27400	1.21094	0.269
YR BY PD	18.68736	12	1.55728	0.82928	0.620
YR BY CAP*	47.73547	6	7.95591	4.23665	0.000*
CU BY PD*	25.31653	4	6.32913	3.37036	0.009*
CU BY CAP	3.34231	2	1.67115	0.88992	0.411
PD BY CAP	0.60911	2	0.30455	0.16218	0.850

Appendix Table 5. Continued

E. School Type 5

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	1750.54997	2062	0.84896		
Constant	215.39491	1	215.39491	253.71701	0.000
SET*	8.73695	1	8.73695	10.29139	0.001*
AR	3.23281	2	1.61640	1.90399	0.149
SN	2.59210	1	2.59210	3.05328	0.081
YR*	14.46684	6	2.41114	2.84012	0.009*
CU	3.25675	2	1.62838	1.91809	0.147
PD	4.67692	2	2.33846	2.75451	0.064
CAP	0.01218	1	0.01218	0.01435	0.905
SET BY AR*	12.09108	2	6.04704	7.12290	0.001*
SET BY SN	1.55251	1	1.55251	1.82873	0.176
SET BY YR	9.55758	6	1.59293	1.87634	0.081
SET BY CU	2.01246	1	2.01246	2.37051	0.124
SET BY PD	3.32677	2	1.66338	1.95932	0.141
SET BY CAP	0.38380	1	0.38380	0.45208	0.501
AR BY SN*	8.21194	2	4.10597	4.83648	0.008*
AR BY YR*	27.30662	12	2.27555	2.68041	0.001*
AR BY CU	3.95048	2	1.97524	2.32667	0.098
AR BY PD	3.60800	4	0.90200	1.06248	0.374
AR BY CAP*	1.81328	2	0.90664	1.06794	0.044*
SN BY YR*	13.67088	6	2.27848	2.68386	0.013*
SN BY CU	2.41742	1	2.41942	2.84987	0.092
SN BY PD	1.02234	2	0.01117	0.01316	0.987
SN BY CAP	0.20208	1	0.20208	0.23803	0.626
YR BY CU	9.84266	6	1.64044	1.93230	0.072
YR BY PD	16.79131	12	1.39928	1.64823	0.072
YR BY CAP	5.66897	6	0.94483	1.11293	0.352
CU BY PD	4.81404	2	2.40702	2.83527	0.059
CU BY CAP	0.21719	1	0.21719	0.25583	0.613
PD BY CAP	3.64053	2	1.82026	2.14412	0.117

Appendix Table 5. Continued

F. School Type 6

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of
Within Cells	385.72990	330	1.16888		
Constant	317.44806	1	317.44806	271.58346	0.000
SET	0.02122	1	0.02122	0.01815	0.893
AR	0.97249	2	0.48625	0.41599	0.660
SN	0.12971	1	0.12971	0.11097	0.739
YR	4.14684	6	0.69114	0.59128	0.737
CU	1.82285	2	0.91143	0.77974	0.459
PD	6.49391	2	3.24696	2.77784	0.064
CAP	0.02023	1	0.02023	0.01731	0.895
SET BY AR	1.14173	2	0.57086	0.48839	0.614
SET BY SN	0.54697	1	0.54697	0.46794	0.494
SET BY YR	8.47366	6	1.41228	1.20823	0.301
SET BY CU	0.61686	2	0.30843	0.26387	0.768
SET BY PD	2.93497	2	1.46749	1.25546	0.286
SET BY CAP	0.04247	1	0.04247	0.03633	0.849
AR BY SN	1.92367	2	0.96183	0.82287	0.440
AR BY YR	22.51592	12	1.87633	1.60524	0.088
AR BY CU	4.50902	3	1.50301	1.28585	0.279
AR BY PD	5.88368	4	1.47092	1.25840	0.286
AR BY CAP	1.07470	2	0.53735	0.45971	0.632
SN BY YR	6.28297	6	1.04716	0.89587	0.498
SN BY CU	0.34317	2	0.17159	0.14680	0.864
SN BY PD	1.43116	2	0.71558	0.61219	0.543
SN BY CAP	0.21882	1	0.21882	0.18721	0.666
YR BY CU	3.41069	7	0.48724	0.41685	0.892
YR BY PD	19.20882	12	1.60074	1.36946	0.179
YR BY CAP	3.96445	6	0.66074	0.56528	0.758
CU BY PD	1.24570	2	0.62285	0.53286	0.587
CU BY CAP	0.15261	1	0.15261	0.13056	0.718
PD BY CAP	0.51168	2	0.25584	0.21888	0.804

Appendix Table 5. Continued

G. School Type 7

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within Cells	8165.48501	5268	1.55002		
Constant	466.49585	1	466.49585	300.96193	0.000
SET	0.28368	1	0.28368	0.18302	0.669
AR*	10.23638	2	5.11819	3.30202	0.037*
SN	1.97686	1	1.97686	1.27538	0.259
YR*	20.84525	6	3.47421	2.24140	0.037*
CU*	15.13033	2	7.56516	4.88070	0.008*
PD	0.64056	2	0.32028	0.20663	0.813
CAP	0.49426	1	0.49426	0.31887	0.572
SET BY AR	2.68139	2	1.34070	0.86496	0.421
SET BY SN	1.67073	1	1.67073	1.07788	0.299
SET BY YR	17.52392	6	2.92065	1.88427	0.079
SET BY CU	2.66827	1	2.66827	1.72145	0.190
SET BY PD	7.98982	2	3.99491	2.57733	0.076
SET BY CAP	0.02569	1	0.02569	0.01658	0.898
AR BY SN	5.16862	2	2.58431	1.66728	0.189
AR BY YR*	49.41485	12	4.11790	2.65668	0.001*
AR BY CU*	59.18923	4	14.79731	9.54655	0.000*
AR BY PD	13.59203	4	3.39801	2.19224	0.068
AR BY CAP*	9.51248	2	4.75624	3.06851	0.047*
SN BY YR	10.15037	6	1.69173	1.09143	0.365
SN BY CU	1.49738	2	0.74869	0.48302	0.617
SN BY PD	5.77144	2	2.88572	1.86174	0.156
SN BY CAP	4.05287	1	4.03287	2.61473	0.106
YR BY CU	22.75278	12	1.89606	1.22325	0.260
YR BY PD	23.53693	12	1.96141	1.26541	0.232
YR BY CAP*	20.36919	6	3.39486	2.19021	0.041*
CU BY PD*	128.86502	4	32.21626	20.78447	0.000*
CU BY CAP	0.22610	2	0.11305	0.07294	0.920
PD BY CAP	1.57368	2	0.78684	0.50763	0.602